

Chapter 6

RECOMMENDATIONS

INTRODUCTION

This chapter presents 46 recommendations that have been developed to implement the *Lower East Coast Regional Water Supply Plan* (LEC Plan). The preceding chapter identified water source options that form a basis for water resource development projects. Water resource development projects are generally those projects that are beyond the scope of traditional local water supply development efforts. **Chapter 5** described water resource development projects for the region and estimated the quantities of water that would be made available. The purpose of this chapter is to provide additional information regarding the resources needed to implement these projects and their expected outputs during the next five years.

Chapter 5 also described a number of water source options that can form a basis for water supply development projects. These options are available to water users to help meet their existing and future water supply needs. This chapter recommends that individual water users in locations where local water supplies are constrained evaluate these water source options for applicability to their local conditions.

Water Resource Development Projects

Water resource development projects for the Lower East Coast (LEC) Planning Area are grouped by the scope and nature of the recommended project as follows:

1. Ongoing projects from the *Interim Plan for Lower East Coast Regional Water Supply* (LEC Interim Plan) (SFWMD, 1998b)
2. Other federal, state, and South Florida Water Management District (District, SFWMD) projects
3. Comprehensive Everglades Restoration Plan (CERP) projects
4. Recommendations to the CERP resulting from analysis performed during the LEC regional water supply planning process
5. Recommendations to the CERP from the *Caloosahatchee Water Management Plan* (CWMP) (SFWMD, 2000d)
6. Operational recommendations resulting from LEC water supply planning process analysis
7. Consumptive use permitting and resource protection projects
8. Other water resource development projects

Potential funding sources for these projects were discussed and a funding strategy was proposed. The Florida Legislature passed the Everglades Restoration Investment Act of 2000, enacting the Governor's proposal for CERP funding. Funding will be consistent with the Governor's plan for CERP funding and will be approved by the District's Governing Board.

At the District level, the recommendations of the final LEC Plan were approved by the Governing Board and incorporated into the *Five-Year Water Resource Development Work Program*, which documents the District's progress in water supply plan implementation. It must be submitted to the Florida Department of Environmental Protection (FDEP) annually (before October 1) for review and approval.

The *Five-Year Water Resource Development Work Program* will also be subject to District Governing Board approval and budgetary appropriation each Fiscal Year (FY)¹. At this time, the implementation schedule for each recommendation has not taken into account other District financial and human resource commitments, as well as commitments that will be generated through approval of the other regional water supply plans currently under development. Thus, schedules identified in the LEC Plan are subject to change based on future District resource and budgetary constraints.

Water Supply Development Projects

Water supply development recommendations, or water source options, are provided for consideration by local governments, water users, and utilities, and are principally the responsibility of users. Water supply development projects may be eligible for District funding assistance, if they meet appropriate criteria explained in Section 373.0831, F.S., and the funding section of this chapter. Funding for water supply development projects is contingent upon the priorities of the Governing Board in light of all other resource or budgetary constraints.

WATER RESOURCE DEVELOPMENT PROJECTS

The water resource development projects are presented in the form of recommendations. Each recommendation, or project, contains a discussion; a list of subtasks (if applicable); the cost to nonfederal entities, which will primarily be borne by the District; total District FTEs²; funding sources, and implementing agencies. The costs and FTEs are also broken down by fiscal year and presented in a table.

Ongoing Projects from the LEC Interim Plan

Significant water supply planning projects were initiated with the completion of the LEC Interim Plan, approved by the Governing Board in March 1998. A number of

1. The District's fiscal year begins on October 1 and ends on September 30.

2. FTE = Full Time Equivalent, which is a worker who works 40 hours each week

these projects involve capital expenditures on the part of the District or its partners, and must be continued to completion. The majority of these projects will be concluding prior to the next update of the LEC Plan and the five-year projections reflect this fact.

Recommendation 1: Regional Saltwater Intrusion Management

Discussion

The water supply planning process requires that the position of the saltwater interface be monitored and the factors causing its movement to be understood. Historically, the District's objective for monitoring has been more to support the development of ground water flow models than to monitor inland saltwater intrusion. The LEC Interim Plan recommended the existing saltwater intrusion monitoring program be evaluated to ensure its reliability in detecting the movement of the saltwater interface and a sampling plan and maintenance schedule be proposed. As a result, six new wells were added to fill data gaps in Palm Beach County. Additional wells and other improvements, plus subsequent data collection, have been undertaken cooperatively with Broward and Miami-Dade counties. These improvements should continue and the data should be incorporated into the future LEC planning analyses, including additional ground water modeling for the future updates of the LEC Plan. The status of the monitoring network will be reassessed during the LEC Plan update and further improvements may be considered at that time.

The minimum Biscayne aquifer ground water levels which can be sustained without causing significant harm to the aquifer through saltwater intrusion are difficult to predict. Therefore, as recommended in the *Draft Minimum Flows and Levels for Lake Okeechobee, the Everglades, and the Biscayne Aquifer* (SFWMD, 2000e), further research will be conducted to refine the relationship between saltwater migration and stage elevations in the Biscayne aquifer. Additionally, a detailed model will be developed that can adequately simulate movement of the saline interface under transient conditions.

In addition, CERP's REstoration, COordination and VERification (RECOVER) team may develop updated surface and ground water flows for Biscayne Bay and Florida Bay that relate to ground water levels and saltwater intrusion. Aquifer monitoring associated with CERP may be eligible for federal cost sharing in future years.

Subtasks

Task 1a. Monitor new network

Task 1b. Develop model to simulate the movement of the saline interface

Summary Information

Cost: \$973,000 over the first five years; \$2,280,000 over the next 15 years

FTEs: 2.0 for the first five years

Funding Sources: SFWMD with local cost sharing by counties

Implementing Agency: SFWMD

Table 77. Estimated Schedule and Costs for Regional Saltwater Intrusion Management.

Recommendation Subtasks		Plan Implementation Costs (\$1,000s and FTEs)													
		FY01		FY02		FY03		FY04		FY05		Total 2001-2005		Total 2006-2020	
		\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
a	Monitor new network	130	0.1	135	0.1	140	0.1	146	0.1	152	0.1	703	0.5	2,280	
b	Develop model		0.3	100	0.3	100	0.3	70	0.3		0.3	270	1.5		
	TOTAL	130	0.4	235	0.4	240	0.4	216	0.4	152	0.4	973	2.0	2,280	

Recommendation 2: Floridan Aquifer System Ground Water Model

Discussion

The LEC Interim Plan determined that the use of alternative water supply sources of Aquifer Storage and Recovery (ASR), reverse osmosis, and Floridan aquifer blending depends on the development of a Floridan Aquifer System (FAS) model. Since then a preliminary model has been developed. However, the interim recommendation to construct a test well in the C-51 West region was not funded. A need for data collection and advanced model development continues in order to identify appropriate Consumptive Use Permitting (CUP) rulemaking and CUP application analysis for the FAS.

This recommendation is to refine the existing FAS ground water flow model using data collected from the construction of ASR projects associated with the CERP, as well as individual utilities with deep well injection facilities. This data would be used to reduce data gaps, support the development and calibration of the proposed model, and evaluate competing uses of the FAS as a water supply source. Following model refinement in 2004, this project is expected to conclude with rulemaking in 2005.

Subtasks

Task 2a. Review and document existing FAS data and identify data gaps

Task 2b. Collect additional data

Task 2c. Refine the existing LEC FAS ground water flow model with new data collected through cooperative agreements, the CUP process, and other available sources or develop a density-dependent model.

Task 2d. Develop rules

Summary Information

Cost: \$555,000 over five years

FTEs: 8.5

Funding Sources: CERP (data collection from regional ASR facilities), SFWMD, water users, and utilities

Implementing Agency: SFWMD

Table 78. Estimated Schedule and Costs for Refining the FAS Ground Water Model.

Recommendation Subtasks		Plan Implementation Costs (\$1,000s and FTEs)											
		FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
		\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
a	Data review and documentation		0.5										0.5
b	Collect additional data	125	1.6	75	0.8	10	0.2	10	0.2	10	0.2	230	3.0
c	Refine FAS model					200	2.0	75	1.0	50	0.5	325	3.5
d	Rule development										1.5		1.5
	TOTAL	125	2.1	75	0.8	210	2.2	85	1.2	60	2.2	555	8.5

Recommendation 3: Northern Palm Beach County Comprehensive Water Management Plan

Discussion

Since 1995, the city of West Palm Beach and the District have cofunded a cooperative planning effort to develop a comprehensive water management plan for much of northern Palm Beach County. The plan focuses primarily on land areas located within the Southern L-8 Basin, the city of West Palm Beach Water Catchment Area/water supply lake system, Loxahatchee Slough, and associated tributary areas (known collectively as the C-18 Basin). The theme of the plan is consistent with the LEC Plan and the CERP, but it also addresses concerns specific to the subregion.

The planning effort includes two phases. During Phase I, completed in 1997, a computer model was developed capable of evaluating the hydrologic, hydraulic, and water quality effects of conceptual water management options for the study area. Phase II water management options have been developed with input from interested and potentially affected stakeholders using the computer model developed in Phase I. The completion of the options analysis is forthcoming once additional modeling simulations have been completed.

Since the interim plan document was completed in March 1998, many planning and implementation efforts are moving forward in northern Palm Beach County. The following is a list of these efforts: continuation of annual water quality monitoring in the L-8 Basin; a contract for the M Canal widening which began in July 1999; surface and ground water modeling; discussion of private/public funding for the Loxahatchee Slough structure; and a General Reevaluation Report (GRR) for the L-8 Basin. The schedule for the completion of these are in **Table 79**. The schedule for the Palm Beach Aggregate GRR is found in Volume 9 of the *Central and Southern Florida Project Comprehensive Review Study Final Integrated Feasibility Report and Programmatic Environmental Impact Statement* (Restudy) (USACE and SFWMD, 1999).

The Northern Palm Beach County Comprehensive Water Management Plan will be completed in 2000. Development of Memorandums of Understanding (MOUs) among the northern Palm Beach County partners needs to be completed to aid in solidifying the operations of this plan. Additional ground water and surface water modeling simulations are also needed. Components of the Northern Palm Beach County Comprehensive Water Management Plan will be implemented through the CERP's Project Implementation Reports (PIRs), and the LEC Plan, with funding from other appropriate federal processes. The PIRs for features in northern Palm Beach County are scheduled to begin in 2002 and end in 2014.

Subtasks

- Task 3a. Complete the Northern Palm Beach County Comprehensive Water Management Plan.
- Task 3b. Continue the M Canal widening contract and complete the improvements to the Control 2 Structure
- Task 3c. Identify private/local funding of the Loxahatchee Slough Structure
- Task 3d. Continue annual L-8 Basin water quality monitoring
- Task 3e. Develop MOUs between northern Palm Beach County partners to implement portions of the Northern Palm Beach County Comprehensive Water Management Plan
- Task 3f. Complete construction of the Beeline Water Control Structure with local partner

Summary Information

Cost: \$2,591,000 over three years

FTEs: 2.9

Funding Sources: City of West Palm Beach, Indian Trail Improvement District, Palm Beach County, CERP and other federal sources, and SFWMD

Implementing Agencies: City of West Palm Beach, Indian Trail Improvement District, and SFWMD

Table 79. Estimated Schedule and Costs for Completing the Northern Palm Beach County Comprehensive Water Management Plan.

Recommendation Subtasks		Plan Implementation Costs (\$1,000s and FTEs)											
		FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
		\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
a	Complete North Palm Beach County Comprehensive Water Management Plan ^a												
b	Continue M Canal widening contract		0.25			400	0.25	400	0.25			800	0.75
c	Identify private/local funding of Loxahatchee Slough Structure	750	0.25	375	0.25	375	0.25					1,500	0.75
d	Continue yearly L-8 Basin water quality monitoring	30	0.10	30	0.10	30	0.10					90	0.30
e	Develop MOUs between northern county partners	1	0.20									1	0.20
f	Beeline Structure	100	0.30	50	0.30	50	0.30					200	0.90
TOTAL		881	1.10	455	0.65	855	0.90	400	0.25			2,591	2.90

a. Scheduled for completion in FY2000

Recommendation 4: Eastern Hillsboro Regional ASR Pilot Project

Discussion

The LEC Interim Plan recommended a regional ASR pilot project (eastern site) to be located west of U.S. 441 along the Hillsboro Canal. The plan recommended that this be accomplished in cooperation with Palm Beach County.

This project is associated with the development of a new wellfield to serve Palm Beach County's Water Treatment Plant Number 9, which is located nearby. The new wellfield will consist of 10 surficial ground water wells to be located along the northern District right-of-way of the Hillsboro Canal. Five wells will be utilized to supply untreated ground water to a proposed five-million gallons per day (MGD) pilot ASR well. The ASR well will be operated to store and recover water that will be delivered to the water treatment plant and to the Hillsboro Canal. The remaining five wells will exclusively serve the water treatment plant and are not associated with the ASR pilot project at this time. If the operational results of this pilot project support the use of the ASR at this location, construction of an additional five-MGD ASR well will be considered.

This project supports the District's mission to manage water and related resources for the benefit of the public. Information relevant to the application of ASR on a regional-

scale will be collected during the construction, testing, and operation of the pilot facility at the eastern site. Hydrogeologic information about the Upper Floridan Aquifer will be obtained and the suitability of the aquifer for ASR will be evaluated. Other issues related to ASR on a regional-scale, such as permitting constraints, water quality, and recovery efficiencies, will be assessed. This project, along with the Hillsboro Western Site (Site 1) pilot ASR project, initiated in the LEC Interim Plan and incorporated into the Restudy, will provide a wide cross-section of pertinent data to be used in evaluating the viability of large-scale, regional ASR systems as anticipated in the CERP.

Subtasks

Task 4a. Construction of the ASR well

Task 4b. Operational testing and operation permit submittal

Summary Information

Cost: \$1,670,000 (SFWMD share)

FTEs: 1.7

Funding Sources: Palm Beach County and SFWMD

Implementing Agency: Palm Beach County

Table 80. Estimated Schedule and Costs for Continuing the Implementation of the Eastern Hillsboro Regional ASR Pilot Project.

Recommendation Subtasks		Plan Implementation Costs (\$1,000s and FTEs)											
		FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
		\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
a	Construction	1,500	1.5	170	0.1							1,670	1.6
b	Operational testing/ operation permit submittal						0.1						0.1
	TOTAL	1,500	1.5	170	0.1		0.1					1,670	1.7

Recommendation 5: Hillsboro (Site 1) Impoundment Pilot Project

Discussion

The LEC Interim Plan recommended a small-scale pilot project impoundment be constructed to assess its performance and to obtain information for a proposed full-scale storage reservoir to capture water lost to tide and return flow to the Hillsboro Canal. The proposed Hillsboro reservoir has been incorporated into the CERP. Seepage rates will be measured and the resulting influence on surrounding ground water levels monitored to

determine construction and operational criteria for the large-scale reservoir. The information will be used to determine the maximum storage depth, embankment geometry, size, and control level of seepage collection systems. Pilot seepage collection systems will be evaluated as source water for the Hillsboro pilot ASR wells.

Subtasks

Task 5a. Construction

Task 5b. Operation and testing

Summary Information

Cost: \$3,420,000

FTEs: 3.1

Funding Source: SFWMD

Implementing Agency: SFWMD

Table 81. Estimated Schedule and Costs for the Hillsboro (Site 1) Impoundment Pilot Project.

Recommendation Subtasks		Plan Implementation Costs (\$1,000s and FTEs)											
		FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
		\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
a	Construction	2,220	1.1	600	0.5							2,820	1.6
b	Operation and testing			200	0.5	300	0.5	100	0.5			600	1.5
	TOTAL	2,220	1.1	800	1.0	300	0.5	100	0.5			3,420	3.1

Recommendation 6: Lake Worth Lagoon Minimum/Maximum Flow Targets

Discussion

The LEC Interim Plan recommended hydrologic and ecologic studies be conducted to identify the appropriate freshwater flows to the Lake Worth Lagoon. These primarily contractual studies would be managed by the District in cooperation with Palm Beach County. The studies will include research and modeling to determine how to better manage freshwater flows, improve water quality, and reestablish seagrass communities. District staff are in the process of obtaining additional hydrodynamic/salinity data to complete the development of the model for Lake Worth Lagoon by February 2001. Basin boundaries for the model are being expanded to include the Lake Worth Creek/Intracoastal Waterway segment and south of Boynton Inlet to the bridge structure at Ocean Ridge/Boynton Beach. The model is also being modified to recognize the location of the C-51

Divide Structure west of U.S. 441. The model will be used to analyze existing and future variable controlled freshwater flows from canal discharge, rainfall, runoff, ground water inflow, and tides. A major goal of these efforts is to manage freshwater flows to the lagoon in a manner that will improve water quality, reduce the transport and deposition of suspended solids in the lagoon, and provide for the reestablishment and sustainability of this ecosystem. With the completion of the model development phase, District staff will need to perform simulations, verify the results of the modeling efforts with current conditions within the biological communities of the lagoon, and monitor the performance of the recommended target flows and the effectiveness of implemented Lake Worth Lagoon Partnership Grant projects.

Additional studies will be considered after FY 2001 to better define relationships among canal discharges, local drainage, and storm water discharges, water quality, sediment deposition and distribution, and the distribution and composition of important biological communities in the lagoon. These studies will provide the background data and understanding needed to support the implementation of CERP Lake Worth Lagoon sediment removal efforts that are scheduled to begin in 2005.

Subtasks

Task 6a. Complete model simulations

Task 6b. Complete aerial photography of sea grasses in Lake Worth Lagoon

Task 6c. Digitize mapping of sea grasses based on aerial photography

Task 6d. Establish and monitor fixed transects to verify aerial photography signatures and monitor the impacts of controlled and noncontrolled releases and the implementation of storm water improvement projects affecting Lake Worth Lagoon

Task 6e. Publish the recommended flow targets in a peer reviewed, scientific journal.

Cost: \$100,000 (SFWMD)

FTE: 1.0 (SFMWD)

Funding Sources: Palm Beach County and SFWMD

Implementing Agencies: SFWMD and Palm Beach County Department of Environmental Resources Management (DERM)

Table 82. Estimated Schedule and Cost for Developing Lake Worth Lagoon Minimum and Maximum Flow Targets.

Recommendation	Plan Implementation Costs (\$1,000s and FTEs)											
	FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
Develop Lake Worth Lagoon minimum and maximum flow targets	100	1									100	1.0

Recommendation 7: Northern Broward County Secondary Canals Recharge Network

Discussion

The LEC Interim Plan recommended the development of a master plan to complete the interconnection of surface water infrastructure to allow conveyance of water to maintain/enhance subregional ground water levels, benefit wellfields, and selected wetlands, and to prevent saltwater intrusion. The ultimate purpose of this project is to control coastal secondary canals at optimal seasonal levels for maintaining and improving ground water recharge and storage. The source of supply for the secondary canal recharge network is from regional surface water sources including aboveground reservoirs in the vicinity of the Hillsboro Impoundment, Lake Okeechobee, and Water Conservation Areas (WCAs), or ASR return flows into the Hillsboro Canal. The project includes construction of canal interconnections, conveyance improvements, pump stations, and monitoring stations. As a part of the Broward County Integrated Water Resource Plan, a master plan will be developed for the interconnection of secondary canals from the Hillsboro Canal Basin to the North New River Canal Basin within Broward County. The master plan, when implemented, will work in conjunction with and enhance the functionality of proposed CERP components. The master plan should be developed in phases and used to incrementally schedule the necessary capital improvements.

A surface water model has been completed. The S-46 Pump Station is scheduled for completion in July 2000. The S-1 Pump Station is expected to be operational in September 2001. The District has shared the cost of these improvements with Broward County and the city of Fort Lauderdale. The county and the District will develop a master plan for the interconnection of secondary canals from the Hillsboro Canal Basin to the North New River Canal Basin that will work in conjunction with and enhance the functionality of proposed CERP components. The master plan should be developed in phases and used to incrementally schedule the necessary capital improvements.

Subtasks

Task 7a. Develop a master plan

Task 7b. Implement the master plan

Task 7c. Design and build the C-12/C-13 InterconnectEstimated costs: \$1,900,000 for the initial phaseFTEs: 0.4Funding Sources: Broward County, Fort Lauderdale, and SFWMDImplementing Agencies: Broward County, Fort Lauderdale, SFWMD, and other local governments**Table 83.** Estimated Schedule and Costs for the Northern Broward County Secondary Canals Recharge Network.

Recommendation Subtasks		Plan Implementation Costs (\$1,000s and FTEs)											
		FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
		\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
a	Develop master plan	100	0.1									150	0.1
b	Implement master plan			550	0.1	600	0.1	600	0.1			1,750	0.3
c	Design and build C-12/C-13 Interconnect	50											
TOTAL		150	0.1	550	0.1	600	0.1	600	0.1			1,900	0.4

Recommendation 8: Southeast Broward County Interconnected Water Supply System**Discussion**

An interagency agreement for the development of an integrated water supply system between the service areas of Hollywood, Hallandale Beach, Dania Beach, Broward County, and possibly the Seminole Tribe of Florida and other communities will be developed through a mediated process. The agreement will result in a design study identifying the locations and costs of regional wellfield expansion and water treatment facilities. The analysis of the LEC Plan indicates that the existing coastal wellfields in southeast Broward County will be unable to provide a 1-in-10 year level of certainty. However, the analysis indicates that a 1-in-10 year level of certainty or higher can be obtained by using the Broward County South Regional Wellfield in the vicinity of Brian Piccolo Park in conjunction with continued use of some coastal wellfields. The final model simulations successfully met the demand of southeast Broward County using 22 MGD from coastal facilities and the remainder from the regional wellfield. Other combinations of options appear to be available to achieve this target.

Other water supply options, including Floridan systems, reuse, ASR, and other facilities could also be useful. The selection of a preferred solution for this subregion should be made by southeast Broward interests. This mediated process is an outgrowth

from, and in support of, the District's CUP effort. The agreement will identify a combination of local and regional wellfield utilization, wellfield recharge, water treatment facilities, and/or alternatives sources, which will meet the future needs of the area.

Hollywood Reservation. The Seminole Tribe of Florida is currently reviewing its options to self-supply its Hollywood Reservation by shifting supply of its public water supply demands to its own utility system. The average and maximum daily demands associated with this facility during the planning horizon are expected to be approximately 1.5 MGD and 2.0 MGD, respectively. The modeling analyses performed to support the LEC regional water supply planning process did not include these demands in the model assumptions, but did evaluate withdrawals on the Hollywood Reservation at a rate of 0.88 MGD on average. It is staff's opinion that average withdrawals of 1.5 MGD and a maximum daily withdrawal of 2.0 MGD on the Hollywood Reservation are attainable. In addition, the Seminole Tribe has agreed to participate in the Southeast Broward County Interconnected Water Supply System discussions. These discussions will deal with developing water supply solutions for the water supply utilities of southeast Broward County, while protecting the water rights of the Seminole Tribe.

Summary Information

Cost: \$400,000 over the next three fiscal years

FTEs: 1.1

Funding Sources: The cities of Hallandale Beach, Hollywood, and Dania Beach; Broward County; the SFWMD; and the Seminole Tribe of Florida

Implementing Agencies: The cities of Hallandale Beach, Hollywood, and Dania Beach; Broward County; the SFWMD; and the Seminole Tribe of Florida

Table 84. Estimated Schedule and Costs for the Southeast Broward County Interconnected Water Supply System.

Recommendation	Plan Implementation Costs (\$1,000s and FTEs)											
	FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
Southeast Broward County Interconnected Water Supply System	300	0.5	50	0.5	50	0.1					400	1.1

Recommendation 9: Broward County Urban Environmental Enhancement

Discussion

The available sources and methods for distributing surface water to benefit specific wetland restoration systems will be examined in the Broward County Integrated Water Resource Plan. Local environmental demands will need to be assessed in terms of quantities and timing of deliveries. Once identified, the county and District are prepared to assess the availability of regional and alternative sources of water to meet this demand. Reservation of water will be addressed by the District, and the District will encourage development of alternative sources, such as the reuse of reclaimed water.

Subtasks

- Task 9a. Work with county staff to identify wetland systems, sources of water supply, and timing of deliveries for augmentation, including reuse of reclaimed water
- Task 9b. Conduct evaluation of availability of supplemental water from reuse and regional storage for average and 1-in-10 year drought conditions
- Task 9c. Identify strategies to meet water demands where structural alternatives are necessary
- Task 9d. Identify volumes and sources of supply to be covered by a reservation of water
- Task 9e. Adopt rules to enact reservation if necessary

Summary Information

Cost: \$200,000 within next three years

FTEs: 0.3

Funding Sources: Broward County and SFWMD

Implementing Agencies: Broward County and SFWMD

Table 85. Estimated Schedule and Costs for Broward County Urban Environmental Enhancement.

Recommendation	Plan Implementation Costs (\$1,000s and FTEs)											
	FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
Broward County Urban Environmental Enhancement	100	0.1	50	0.1	50	0.1					200	0.3

Recommendation 10: Miami-Dade Water and Sewer Department Utility ASR

Discussion

The LEC Interim Plan recommended the development of local ASR in LEC Service Area 3 and provided funding to Miami-Dade County to begin constructing two 5.0-MGD wells. These will be complete by June 2000. These ASR wells use untreated water from the Biscayne aquifer and return water directly to Miami-Dade Water and Sewer Department (WASD) treatment plants. Miami-Dade WASD proposes to have 35 MGD of ASR capacity available in 2005 and 75 MGD of ASR capacity in 2020.

Summary Information

Cost: \$7,500,000 over next five years (SFWMD share); \$12,000,000 for the additional 40 MGD (eight additional wells)

FTEs: 0.1 per year; 0.5 total for the next five years

Funding Sources: Miami-Dade WASD, SFWMD, and the United States Environmental Protection Agency (USEPA)¹

Implementing Agency: Miami-Dade WASD

Table 86. Estimated Schedule and Costs for Developing the Miami-Dade WASD Utility ASR.^a

Recommendation	Plan Implementation Costs (\$1,000s and FTEs)													
	FY01		FY02		FY03		FY04		FY05		Total 2001-2005		Total 2006-2020	
	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
Miami-Dade WASD Utility ASR	1,500	0.1	1,500	0.1	1,500	0.1	1,500	0.1	1,500	0.1	7,500	0.5	12,000	1.5

a. Only average annual costs are reported. Several years may be combined into a single fiscal year.

Recommendation 11: Biscayne Bay Minimum and Maximum Flow Targets

Discussion

A major recommendation of the LEC Plan is to identify the freshwater flows that support the maintenance of environmentally desirable flow and salinity targets for Biscayne Bay. The completion of an ecological model for Biscayne Bay will complement the hydrodynamic model developed by the U.S. Army Corps of Engineers – Waterways Experiment Station (USACE-WES) and the ground water model developed for Biscayne Bay by the U.S. Geological Survey (USGS). The completion of these tools will enable

1. An additional \$500,000 may be available in FY 2001 from the USEPA.

scenarios of varying freshwater inflows to be evaluated, resulting in recommendations for a salinity regime.

Subtasks

Task 11a. Interagency review of models, scenarios, and standards

Task 11b. Data processing

Task 11c. Conduct secondary review

Task 11d. Publish final report of recommended Minimum Flows and Levels (MFL) technical criteria

Task 11e. Develop a MFL recovery plan or prevention strategy for those areas that do not meet the proposed MFL criteria

Task 11f. Conduct rule development and rulemaking

Summary Information

Cost: \$200,000

FTEs: 2.2

Funding Sources: Florida Forever Act, Surface Water Improvement Management (SWIM), and CERP

Implementing Agencies: SFWMD, Miami-Dade County DERM, and USACE

Table 87. Estimated Schedule and Costs for Developing Biscayne Bay Minimum and Maximum Flow Targets.

Recommendation Subtasks		Plan Implementation Costs (\$1,000s and FTEs)											
		FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
		\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
a	Interagency review		0.1		0.1								0.2
b	Data processing	200	0.5									200	0.5
c	Secondary review		0.2		0.1								0.3
d	Final report				0.5								0.5
e	Recovery plan/prevention strategy				0.5								0.5
f	Rulemaking						0.2						0.2
TOTAL		200	0.8		1.2		0.2					200	2.2

Other Federal, State, or District Projects

Recommendation 12: Critical Projects

Other federally cost-shared projects, as a group, include the critical projects in the LEC Planning Area for which the District is the local sponsor. These projects have been part of the without plan conditions in the 2020 Base Case (see **Chapter 4**). These projects are the West Canal Structure (C-4), Western C-11 Water Treatment, and the Lake Okeechobee Water Retention/Phosphorus Removal projects. Each of these was described in **Chapter 5**. **Table 88** provides annual estimates of nonfederal funding responsibility for 2001 to 2005 for the West Canal Structure (C-4) and Western C-11 Water Treatment projects. Costs for the Lake Okeechobee Water Retention/Phosphorus Removal Project have been included as part of the much larger Lake Okeechobee Water Quality Treatment Facilities Project, which is a CERP project (see **Table 93** later in this chapter).

Table 88. Estimated Schedule and Costs for the Critical Projects for which the District is the Local Sponsor.

Critical Project	Plan Implementation Costs (\$1,000s and FTEs)											
	FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
West Canal Structure (C-4)	130	0.35									130	0.35
Western C-11 Water Treatment	2,000	0.85	2,115								4,115	0.85
TOTAL	2,130		2,115								4,245	1.20

Recommendation 13: Well Abandonment Program (Recommendation from the CWMP)

Discussion

The District administered a voluntary well abandonment program that identified abandoned artesian wells, geophysically logged them, and plugged or rehabilitated the wells, as necessary, to prevent deterioration of the Surficial Aquifer System (SAS) through upland leakage or discharge to land surface. This program ended in 1991. The program documentation indicates that there are unplugged wells remaining within the planning area and, if plugged, could contribute an estimated net flow of 50,000 acre-feet (ac-ft) per year to the water budget of the Caloosahatchee Basin. In addition, the Florida Geological Survey, Bureau of Oil and Gas, have identified larger oil test wells within the planning area that have not been adequately plugged.

Additional effort should be made to locate and properly plug the free flowing wells in the Caloosahatchee Basin. The District should work with local and state officials to locate uncontrolled abandoned wells and identify plugging strategies and applicable funding sources for proper plugging of the wells.

The District will coordinate with local and state agencies to identify abandoned, unplugged wells and to identify potential funding sources. This involves staff support and coordination only.

Summary Information

Cost: No direct cost associated with this recommendation

FTEs: 0.5

Funding Sources: Potential sources include landowners, local government, and water resource development funds

Implementing Agency: SFWMD

Table 89. Estimated Schedule and Costs for the CWMP Well Abandonment Program.

Recommendation	Plan Implementation Costs (\$1,000s and FTEs)											
	FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
Coordinate identification of unplugged wells		0.25		0.25								0.50

Recommendation 14: Saltwater Influence at S-79 (Recommendation from the CWMP)

Discussion

Saline water has been a recurring problem for the potable water intakes in the Caloosahatchee River. The potable water intakes are located approximately one mile upstream of the S-79 Structure. During extended periods of low flow, the chloride content of the shallow water increases well beyond the recommended limit of 250 milligrams per liter for drinking water. In response, releases have been made from Lake Okeechobee. A number of alternatives to refine these releases warrant further investigation and include moving the intake farther upstream, modifications to the structure, limiting lockages during low flow periods, improved maintenance and operation of the bubble curtain, and seasonal reductions in river withdrawals. Future freshwater releases for environmental purposes may also minimize saltwater influence. Additional analysis of the front migration should be initiated.

The District will coordinate additional analysis of the saltwater influence problem at the S-79 Structure. This recommendation involves staff support and coordination only.

Summary Information

Cost: No direct cost associated with this recommendation

FTEs: 0.5

Funding Sources: USACE and local government

Implementing Agency: SFWMD

Table 90. Estimated Schedule and Costs for the CWMP Saltwater Influence Analysis.

Recommendation	Plan Implementation Costs (\$1,000s and FTEs)											
	FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
Coordinate identification of needed additional analysis		0.5										0.5

Recommendation 15: Permitting Issues Associated with ASR Systems and Reuse of Reclaimed Water

Discussion

In January 1999, FDEP adopted a new rule dealing with ASR (Section 610.466, F.A.C.). The District should continue working with the Florida Legislature, the USEPA, and the FDEP to explore rule changes to the federal and state Underground Injection Control Program to allow for, and encourage, injection of ground water or surface water for ASR. The level of treatment should be compatible with the water quality in the proposed storage zone. Existing rule criteria will be identified and modified to facilitate changes in ASR regulations that will, in turn, facilitate the development of water source options.

As a follow-up to the recent FDEP wastewater/reclaimed water rule revisions (Chapter 62-610, F.A.C.), the District and FDEP will work in partnership to explore and correct any possible remaining inconsistencies and conflicts within the goals, objectives, and rules of the various programs involved in wastewater and reuse of reclaimed water programs. The objectives of this effort should be to maximize the reuse of reclaimed water to increase the water resources of the District while protecting the quality of the ground and surface waters and protecting the natural resources of the area.

Summary Information

Cost: \$0

FTEs: 0.13

Funding Sources: SFWMD and FDEP

Implementing Agencies: SFWMD and FDEP

Table 91. Estimated Schedule and Costs for Permitting Issues Associated with ASRs.

Recommendation	Plan Implementation Costs (\$1,000s and FTEs)											
	FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
Work with the Florida Legislature, FDEP, and USEPA		0.05		0.05		0.01		0.01		0.01		0.13

Recommendation 16: Mobile Irrigation Labs

Discussion

The Florida Department of Agriculture and Consumer Services (FDACS) should administer and fund the two existing and one additional Mobile Irrigation Labs (MILs) in the LEC Planning Area. To replace current District participation, additional funding sources need to be found. An additional urban MIL is recommended for Broward County.

Subtasks

Task 16a. Identify dedicated funding sources to support existing MILs

Task 16b. Maintain existing MILs in the LEC Planning Area

Task 16c. Establish an additional MIL to serve Broward County

Summary Information

Cost: \$1,513,000 (none by SFWMD)

FTEs: 0.11 (none by SFWMD)

Funding Sources: Potential funding sources are FDEP, FDACS, Soil and Water Conservation Districts (SWCD), user fees, and utilities

Implementing Agencies: SWCD and FDACS

Table 92. Estimated Schedule and Costs for Establishing Mobile Irrigation Labs.^a

Recommendation Subtasks		Plan Implementation Costs (\$1,000s and FTEs)											
		FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
		\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
a	Identify funding sources		0.01		0.01		0.01		0.01		0.01		0.06
b	Maintain existing MILs ^b	200		200		200		200		200		1,000	
c	Establish additional urban MIL ^b	70	0.01	70	0.01	70	0.01	70	0.01	70	0.01	350	0.05
TOTAL		270	0.02	270	0.02	270	0.02	270	0.02	270	0.02	1,350	0.11

a. The District is not funding MILs at this time. The costs and FTEs are included for informational purposes only.

b. Costs shown for the MILs include FTEs to operate.

Comprehensive Everglades Restoration Plan Projects

Recommendation 17: CERP Projects that Affect the LEC Planning Area and the Caloosahatchee Basin

The analysis completed as part of the LEC Plan confirms that the Restudy projects scheduled for completion by 2020 are extremely beneficial for meeting MFLs and natural system restoration targets, including reducing high water flows to estuaries, and providing water to meet demands in the LEC Planning Area. These projects are being refined and implemented in the CERP. The water resource development projects, operational changes, and environmental restoration projects listed in **Table 93** are CERP projects recommended for completion by 2020. These projects are described in detail in **Appendix C**. Completion of the CERP projects by 2020, and timely implementation according to the schedule in the Restudy (USACE and SFWMD, 1999) is crucial to meeting the objectives of the LEC Plan.

The CERP is considered in its entirety as one component of the LEC Plan's program of water resource development projects. Many of the proposed projects have significant water resource benefits that need to be considered in this plan. **Table 93** provides a list of all CERP projects in the LEC Planning Area with annual estimates of nonfederal funding responsibility for fiscal years 2001 to 2005 and the total cost through FY 2020. **Table 94** provides a similar list of all CERP projects in the Caloosahatchee Basin. **Table G-1** in **Appendix G** breaks down the total nonfederal and federal costs through 2050 of these projects into Project Implementation Report (PIR), real estate acquisition, design, plans and specifications, and construction costs. No attempt is made to provide a further breakdown of costs at this time as the resolution of state and federal agreements on funding is still pending.

Table 93. Nonfederal Funding Responsibility of CERP Projects in the Lower East Coast Planning Area.

Project	Cost for Fiscal Year (in 1999 dollars)							
	2001	2002	2003	2004	2005	Total 2001-2005	Total 2006-2020	Total 2001-2020
Lake Okeechobee ASR Pilot Project	5,066,667	1,532,308	401,539	293,846		7,294,359		7,294,359
Lakebelt Technology Pilot Project	572,650	2,230,770	2,230,770	2,239,317	2,230,770	9,504,275	995,727	10,500,002
Reuse Technology Pilot Project	514,520	410,158	2,793,843	4,578,736	5,691,534	13,988,790	494,231	14,483,021
Seepage Management Pilot Project	326,282	4,220,193	447,116	6,411		5,000,001		5,000,001
Hillsboro (Site 1) ASR Pilot Project	1,595,193	2,255,962	198,847			4,050,001		4,050,001
Lake Okeechobee ASR				1,560,123	5,735,099	7,295,221	541,360,780	548,656,001
Lake Okeechobee Watershed Water Quality Treatment Facility		494,395	546,680	7,345,724	7,180,656	15,567,455	15,556,046	31,123,501
North of Lake Okeechobee Storage Reservoir							142,427,001	142,427,001
L-8 Project				37,718	2,461,054	2,498,772	33,159,228	35,658,000
Lake Okeechobee Tributary Sediment Dredging		52,334	487,942	467,726	1,342,000	2,350,001		2,350,001
Taylor Creek/Nubbin Slough Storage Reservoir and Treatment Area	766,000	10,310,685	14,918,910	4,920,230	79,598	30,995,423	20,502,500	51,497,923
EAA Storage Reservoir, Phase 1	1,603,500	1,606,585	1,207,376	1,204,286	1,413,124	7,034,870	108,059,463	115,094,333
EAA Storage Reservoir, Phase 2							101,620,001	101,620,001
C-17 Backpumping and Treatment			3,209,550	3,548,110	3,425,414	10,183,074	-88,073 ^a	10,095,002
Pal-Mar/J.W. Corbett WMA Hydropattern Restoration		3,953,899	3,923,666	8,435		7,886,000	-2,636,000 ^a	5,250,000
C-51 and Southern L-8 Reservoir				153,330	10,004,740	10,158,070	153,869,931	164,028,001
Hillsboro (Site 1) Impoundment, Phase 1	14,948,261	4,271,899	4,239,560	51,104		23,510,825	-4,243,325 ^a	19,267,500
Hillsboro (Site 1) ASR			637,773	705,049	702,358	2,045,179	44,376,821	46,422,000
Acme Basin B Discharge		4,339,627	4,306,681	39,693		8,686,000	1,364,000	10,050,000
C-51 Backpumping and Treatment			4,262,012	4,711,592	4,481,069	13,454,673	2,861,327	16,316,001
C-51 Regional Ground Water ASR				81,054	5,288,784	5,369,838	58,275,662	63,645,500
Lake Worth Lagoon Restoration							1,150,000	1,150,000
Winsburg Farms Wetlands	792,917	2,770,281	705,443	8,360	2,152,712	6,429,712	537,289	6,967,001
Protect Wetlands next to WCA-1	35,810,775	0	5,494,036	6,073,576	498,813	47,877,201	-21,491,200 ^a	26,386,001

Table 93. Nonfederal Funding Responsibility of CERP Projects in the Lower East Coast Planning Area.

Project	Cost for Fiscal Year (in 1999 dollars)							
	2001	2002	2003	2004	2005	Total 2001-2005	Total 2006-2020	Total 2001-2020
Palm Beach County Agricultural Reserve Reservoir and ASR					1,604,874	1,604,874	59,074,626	60,679,500
Western C-11 Diversion Impoundment and Canal		41,039,740	40,726,379	144,381		81,910,501	-19,492,000 ^a	62,418,501
C-9 STA/Impoundment		31,207,331	30,968,887	89,308		62,265,526	-17,692,525 ^a	44,573,001
Broward County Secondary Canal System	37,750	151,581	415,662	509,514	1,193,509	2,308,016	4,140,985	6,449,001
North Lake Belt Storage Area (NLBSA), Phase 1							118,837,387	118,837,387
Central Lakebelt Storage Area (CLBSA), Phase 1							163,570,773	163,570,773
C-4 Control Structures	64,359	251,777	207,614	5,325	618,875	1,147,950		1,147,950
Pineland and Hardwood Hammock Restoration	8,334	7,190	3,993	73,010	140,288	232,813	67,188	300,000
Bird Drive Recharge Area				10,834,465	14,427,528	25,261,993	36,779,508	62,041,501
L-31N Levee Improvements for Seepage Management			217,539	237,480	236,573	691,591	32,199,409	32,891,000
Dade-Broward Levee/ Pennsuko Wetlands		4,402,418	4,368,948	34,235	0	8,805,600	583,400	9,389,000
Reroute Miami Canal Water Supply Deliveries		8,692,877	12,891,141	4,220,652	54,831	25,859,501	11,627,000	37,486,501
C-111 North Spreader Canal	3,151,565	15,097,629	15,097,629	12,352,339	134,716	45,833,876	737,150	46,571,027
South Miami-Dade County Reuse							181,512,002	181,512,002
West Miami-Dade County Reuse							218,618,501	218,618,501
WCA-1 Internal Canal Structures	187,412	738,350	2,807,104			3,732,866		3,732,866
Diverting Flows from WCA-2 to CLBSA							38,078,001	38,078,001
WCA-3A and B Levee Seepage Management		27,797,554	27,850,757	27,558,039		83,206,350	-33,352,850 ^a	49,853,500
Additional S-345 Structures		112,708	167,141	167,781	167,141	614,770	22,611,731	23,226,501
Construction of S-356 Structures and Relocation of a Portion of L-31N Borrow Canal			28,154,278	31,124,139	30,972,344	90,250,762	-32,877,761 ^a	57,373,001
Decomartmentalize WCA-3, Phase 1		250,301	371,184	180,690	1,507,295	2,309,470	10,618,031	12,927,501
Decomartmentalize WCA-3, Phase 2							29,602,000	29,602,000

Table 93. Nonfederal Funding Responsibility of CERP Projects in the Lower East Coast Planning Area.

Project	Cost for Fiscal Year (in 1999 dollars)							
	2001	2002	2003	2004	2005	Total 2001-2005	Total 2006-2020	Total 2001-2020
Flow to Northwest and Central WCA-3A	259,789	212,054	107,161	92,309	1,080,727	1,752,039	8,617,462	10,369,500
Divert flows from WCA-3 to CLBSA							382,501	382,501
Divert Flows from CLBSA to WCA-3B							3,272,000	3,272,000
G-404 Pump Station Modifications				140,405	95,323	235,728	4,833,272	5,069,000
Biscayne Bay Coastal Wetlands	16,667	176,749	630,918	633,335	8,477,416	9,935,084	139,835,456	149,770,540
Florida Keys Tidal Restoration	18,268	41,643	21,391	281,075	253,700	616,077		616,077
Big Cypress/L-28 Interceptor							21,375,501	21,375,501
Miccosukee Tribe Water Management Plan	312,334	1,841,522	117,701	88,111	1,238,693	3,598,360	8,553,058	12,151,418
Seminole Tribe Big Cypress Water Conservation Plan	716,750	1,517,397	3,166,194	2,404,712	358,019	8,163,071	29,480,930	37,644,001
Melaleuca Eradication Project and other Exotic Plants							2,886,001	2,886,001
PIR for Storage and ASR Storage ^b		3,947,458	3,947,458	3,902,085		11,797,000		11,797,000
PIR for Lake Belt Storage and Conveyance ^b							17,521,500	17,521,500
PIR for WCA Connectivity ^b	1,300,500	425,164				1,725,664		1,725,664
PIR for Levee Seepage Management ^b	955,251	1,837				957,088		957,088
Comprehensive Ecosystem Water Quality Improvement Study	639,607	642,067	642,067	644,527	642,067	3,210,333	787,208	3,997,541
Florida Bay Feasibility Study	461,539	501,923	501,923	503,846	30,770	2,000,000		2,000,000
RECOVER	4,985,060	5,004,233	5,004,233	5,023,407	5,004,233	25,021,166	75,025,151	100,046,316
Total for CERP Projects in the LEC Planning Area	75,111,944	182,510,599	228,399,042	139,279,580	120,926,642	746,227,802	2,335,963,999	3,082,191,801

- a. While overall CERP project costs are shared 50-50 with the USACE, the timing of the payments varies, as do the activities for which the local sponsor is fully responsible. The local sponsor is generally responsible for 100 percent of the land acquisition costs, but the credit, for purposes of calculating the 50-50 share, is not given until the end of the project, resulting in situations where the local sponsor has spent more than the 50 percent requirement at the end of the project, and must get reimbursed by the USACE, hence the apparent negative funding requirement.
- b. In most cases, a PIR will be developed for each project and the cost of the PIR is included in the project costs. This PIR will address several related projects (see **Table G-1** in **Appendix G** for more details).

Table 94. Nonfederal Funding Responsibility of CERP Projects in the Caloosahatchee Basin.

Project	Cost for Fiscal Year (in 1999 dollars)							
	2001	2002	2003	2004	2005	Total 2001-2005	Total 2006-2020	Total 2001-2020
Caloosahatchee River ASR Pilot Project	250,000	2,298,077	278,846	83,975	83,654	2,994,552	5,448	3,000,000
C-43 Basin Storage Reservoir and ASR	2,154,334	2,162,620	23,925,026	66,386,023	43,465,970	138,093,972	81,282,655	219,376,628
Caloosahatchee Backpumping with STA							41,447,501	41,447,501
Southwest Florida Study	1,000,000	1,800,000	1,800,000	1,000,000	500,000	6,100,000	-6,100,000 ^a	
Total for CERP Projects in the Caloosahatchee Basin	3,404,334	6,260,697	26,003,872	67,469,997	44,049,624	147,188,524	116,635,604	263,824,129

a. While overall CERP project costs are shared 50-50 with the USACE, the timing of the payments varies, as do the activities for which the local sponsor is fully responsible. The local sponsor is generally responsible for 100 percent of the land acquisition costs, but the credit, for purposes of calculating the 50-50 share, is not given until the end of the project, resulting in situations where the local sponsor has spent more than the 50 percent requirement at the end of the project, and must get reimbursed by the USACE, hence the apparent negative funding requirement.

Recommendations to the CERP from the LEC Plan

LEC Plan analysis indicates refinement of some of the CERP projects may improve their performance. These suggestions for further refinement are discussed below. The LEC Plan recommends that these modifications be analyzed in the planning and design of CERP projects during the PIR and RECOVER process and in any operational changes for these features.

Recommendation 18: S-155A

The LEC Plan recommends that additional analysis in the design phase of CERP determine the most effective method to provide water to the C-51 Backpumping and Treatment component, while continuing to provide benefits to the Lake Worth Lagoon without affecting the location of S-155A as designed for the Everglades Construction Project.

Recommendation 19: Everglades Hydropatterns within WCA-2B

Results of regional modeling efforts performed as part of the LEC Plan identified WCA-2B as the only area of the northern Everglades that received an unacceptable score for the incremental (2005, 2010, and 2015) and LEC-1 Revised simulations, as well as for the LEC-1 simulations. These results indicate this area of the Everglades fails to meet LEC regional water supply planning targets, and ecosystem recovery is not likely to occur unless significant hydrologic improvements are made to the area. These results are similar

to the modeling results recorded in Appendix D of the Restudy (USACE and SFWMD, 1999).

It is the intent of the LEC regional water supply planning process to implement the recommendations of the CERP's RECOVER teams to restore or improve Everglades hydropatterns within WCA-2B. The RECOVER teams will have the lead responsibility for identifying potential improvements in design or operations that will resolve any remaining performance problems currently predicted for both the CERP and the LEC Plan for this area of the Everglades Basin.

The approach, which will be used by the RECOVER teams to improve WCA-2B, will be to review and refine, where necessary, the performance measures and indicator regions used to evaluate hydrological performance. An increase in the number of indicator cells in WCA-2B may be required to better understand the nature of the hydrological performance problem and potential solutions. Once performance measures are reviewed, additional structural improvements and operational features will be suggested and modeled to determine potential solutions to WCA-2B performance. Once these improvements have been identified, they will be presented to the LEC Regional Water Supply Plan Advisory Committee and the District's Governing Board for review and approval and implemented as part of the next update of the LEC Plan.

Recommendation 20: Everglades Agricultural Area Storage Reservoirs

This feature as designed in the Restudy includes aboveground reservoir(s) with a total storage capacity of approximately 360,000 ac-ft located in the Everglades Agricultural Area (EAA) in western Palm Beach County and conveyance capacity increases for the Miami, North New River, Bolles, and Cross canals. The initial design for the reservoir(s) assumed 60,000 acres, divided into three, equally-sized compartments (1, 2A, and 2B), with the water level fluctuating up to six feet above grade in each compartment. The final size, depth, and configuration of this facility will be determined through more detailed planning and design.

The purpose of this CERP feature is to improve the timing of environmental deliveries to the WCAs, including reducing damaging flood releases from the EAA to the WCAs, reducing Lake Okeechobee regulatory releases to the estuaries, meeting EAA irrigation and Everglades water demands, and increasing flood protection in the EAA.

Runoff from the EAA, the Miami Canal Basin, and the North New River Canal Basin and regulatory releases from Lake Okeechobee will be pumped into the reservoirs. Compartment 1 discharges will be used to meet EAA irrigation demands. Compartment 2A discharges will be used to meet environmental demands as a priority and can be used to supply a portion of agricultural demands if the environmental demands equal zero. Compartment 2B discharges will be used to meet environmental demands.

The LEC Plan recommends investigating four changes to this feature be considered in the future CERP analyses as a means of optimizing EAA water supply without adversely impacting water deliveries to the natural system. First, the sizes of the

reservoirs would be modified. This change would enable more water supply demands in the EAA to be met. Compartment 1 could be increased to 30,000 acres to meet EAA irrigation demands; Compartment 2A would remain the same size (20,000 acres), and Compartment 2B would be decreased to 10,000 acres. Second, the runoff from the portion of the Hillsboro Canal Basin within the EAA could be captured and routed to the enlarged Compartment 1. Third, Compartment 1 could be used to meet demands in the West Palm Beach Canal Basin, as well as the other EAA basins. By implementing these changes, a greater percentage of future EAA demands can be met. Fourth, structural and conveyance changes may be necessary to implement these modifications. Excess water available in ASR facilities in LEC Service Area 1 will be diverted, when possible, to partially meet its demands to the EAA.

The following discussion compares the flows from the LEC-1 simulation to the flows from the LEC-1 Revised simulation. In the LEC-1 simulation, the compartments were all the same size, as recommended in the Restudy. The altered compartment sizes were incorporated into the LEC-1 Revised simulation. The flows discussed below were generated from the standard budget ASCII (American Standard Code for Information Interchange) files and are the mean values of the 31-year simulation.

EAA runoff into Compartment 1 of the EAA Storage Reservoirs was 45,000 ac-ft per year more in LEC-1 Revised simulation than in the LEC-1 simulation. Furthermore, 18,000 ac-ft per year was routed from excess water in regional ASR in LEC Service Area 1 to Compartment 1. In the LEC-1 Revised simulation, water supply to the EAA was 47,000 ac-ft per year more from Compartment 1 than in the LEC-1 simulation. In the LEC-1, this additional supply was used to meet needs in the West Palm Beach Canal Basin, in addition to meeting the needs in the Miami and North New River canal basins. Total flow from Lake Okeechobee to Compartments 2A and 2B was 11,000 ac-ft per year more in the LEC-1 Revised than in the LEC-1. Total supply from Compartments 2A and 2B to meet environmental needs was 23,000 ac-ft per year more in the LEC-1 Revised than in the LEC-1. Modifications to the EAA Storage Reservoirs had no effect on performance of the natural system, which were the same in both the LEC-1 and LEC-1 Revised simulations under average conditions (31-year mean) and drought conditions (five driest years).

The flows discussed above should not be considered measures of performance. In the revised simulations, changes due to the EAA reservoir modifications were not analyzed independently of other changes made in the revised simulations. Instead, performance of these modifications should be measured in terms of impacts on Lake Okeechobee, hydroperiods in the Everglades, and on water supply performance.

Recommendation 21: L-8 Project

This Restudy component was designed to include a combination of aboveground and in-ground reservoirs with a total storage capacity of approximately 48,000 ac-ft located immediately west of the L-8 Borrow Canal and north of the C-51 Canal in Palm Beach County. Other construction features include ASR wells with a capacity of 50 MGD, a series of pumps, water control structures, and canal capacity improvements in the

M Canal. The initial design assumed a 1,800-acre reservoir with 1,200 usable acres with the water level fluctuating from 10 feet above grade to 30 feet below grade. The initial design assumed 50 wells, each with a capacity of five MGD with chlorination for pretreatment and aeration for posttreatment.

The purpose of this feature is to increase water supply availability and flood protection for northern Palm Beach County areas. It will also provide flows to enhance hydroperiods in the Loxahatchee Slough, increase base flows to the Northwest Fork of the Loxahatchee River, and reduce high discharges to the Lake Worth Lagoon.

In the Restudy it was assumed water will be pumped into the reservoir from the C-51 Canal and Southern L-8 Borrow Canal during the wet season, or periods when excess water is available, and returned to the C-51 and Southern L-8 canals during dry periods. Additional features will also direct excess water into the West Palm Beach Water Catchment Area. During periods when the West Palm Beach Water Catchment Area is above desirable stages, 50 MGD will be diverted to Lake Mangonia for storage in the ASR wells. The reservoir portion of this component may be implemented under a previously authorized project.

Modeling completed for the LEC Plan optimized the operation of the ASR portion of this feature by utilizing stored ASR water more often and redirecting where the water was distributed. Water stored in excess of a selected threshold could be conveyed to the EAA to meet irrigation demands. Utilizing this water could prevent the volume of water stored from accumulating in excessive volumes, optimize its beneficial use, and reduce demands on the Lake Okeechobee. The LEC Plan recommends development of an operating schedule that can optimize the use of the stored ASR water to meet EAA demands.

Recommendation 22: C-51 Regional Ground Water Projects ASR Facilities

The purpose of this feature is to capture and store excess flows from the C-51 Canal currently discharged to the Lake Worth Lagoon for later use during dry periods. This feature was designed to include a series of ASR wells with a capacity of 170 MGD to be constructed along the C-51 Canal in Palm Beach County. The initial design of the wells assumed 34 well clusters, each with a capacity of five MGD with chlorination for pretreatment and aeration for posttreatment.

The design includes facilities used to inject and store surficial aquifer ground water adjacent to the C-51 Canal into the Upper Floridan aquifer instead of discharging the canal water to tide. Water will be returned to the C-51 Canal to help maintain canal stages during the dry season. If water is not available in the system, existing rules for water delivery to this region will be applied.

The analysis performed during the LEC regional water supply planning process optimized the operation of the ASR features by utilizing stored ASR water more often and redirecting where it is distributed. Water stored in excess of the water requirements to maintain the C-51 Canal and Lake Worth Drainage District could be conveyed to the EAA

to meet irrigation demands. Utilizing this water prevents the volume of water stored from accumulating in excessive volumes and optimizes its beneficial use.

Recommendation 23: West Miami-Dade Reuse Feasibility Study

This feature was designed to produce superior, advanced treatment of wastewater from a future wastewater treatment plant in western Miami-Dade County. The plant will be located in the Bird Drive Basin in Miami-Dade County. The initial design assumed a potential discharge volume of 100 MGD from the wastewater treatment plant. The final configuration of these facilities will be determined through more detailed planning and design to be completed in the ongoing West Miami-Dade Water Reuse Feasibility Study authorized in Section 413 of the Water Resources Development Act of 1996. Superior water quality treatment features would be based on appropriate pollution load reduction targets necessary to protect downstream receiving surface waters.

The purpose for the feature is to meet the demands for the Bird Drive Recharge Area, the South Dade Conveyance System, and Northeast Shark River Slough. When all demands have been met, the plant would stop treatment beyond secondary treatment standards and will dispose of the secondary treated effluent into deep injection wells.

In the Restudy, it was recognized that further study would look at other options and consider cost-effective alternatives. In the models used during the LEC regional water supply planning process, the quantity of reuse being produced was assumed to be only 50 MGD. The LEC Plan recommends that, as part of the West Miami-Dade Reuse Feasibility Study, the volume of reuse water needed to meet identified demands should be reevaluated, that other beneficial uses of reclaimed water should also be considered, and that alternative sources of water should be analyzed.

Recommendation 24: Lake Okeechobee Regulation Schedule

Modifications to the Lake Okeechobee regulation schedule, Run 25, were recommended in the Restudy. These modifications would take advantage of the additional storage facilities identified in the construction features. Two additional zones will be added to the schedule. The first zone will trigger discharges to the North of Lake Okeechobee Storage Reservoir and the EAA Storage Reservoir. The second higher zone will trigger the Lake Okeechobee ASR facilities to begin injecting water from the lake. Climate-based forecasting will be used to guide management decisions regarding releases to the storage facilities.

As part of the analysis performed for the LEC Plan, a Water Supply and Environmental (WSE) schedule with modifications to accommodate additional storage features, showed superior performance in meeting environmental and water supply demands on the lake. The WSE schedule was recommended by the LEC Interim Plan and continues to perform better than the modified Run 25 schedule used in the Restudy. The WSE schedule is able to meet a greater percentage of water supply demands in the LEC Planning Area and the Lake Okeechobee Service Area (LOSA), while providing environmental deliveries to the estuaries and the Everglades. Increased storage and

demands on the lake alters operations. The schedule should be updated as major new storage features are constructed or at least every five years over the next 20 years.

Recommendation 25: Lake Belt Storage Area Projects

The Lake Belt storage areas are expected to be complete in 2036. They will extend beyond the 2020 time frame used in the LEC regional water supply planning process. Modeling and analysis for the LEC Plan has shown that completing 50 percent of the planned reservoir capacity is critical in meeting the multiple water resource objectives in the region by 2020. The construction of seepage barriers, which are necessary for this design, will require careful coordination with the limestone mining industry in order to obtain a portion of reservoir capacity before mining is complete. Likewise, pilot studies to test the feasibility of some aspects of the concept are critical and will require ongoing coordination with the mining industry. The LEC Plan recommends the identification of seepage barrier locations early on and coordination with the mining industry on the timing of mining so that blasting will not cause damage to seepage barriers.

Recommendation 26: Everglades Rain-Driven Operations

Modifications to the regulation schedules for WCAs 2A, 2B, 3A, 3B, and the current rainfall delivery formula for Everglades National Park were recommended in the LEC Interim Plan and in the Restudy to implement rain-driven operations for all of these areas. These new operational rules are intended to improve timing and range of water depths in the WCAs and Everglades National Park to restore more natural hydropatterns, as well as meet MFLs for these areas.

The rain-driven operational concept is a basic shift from the current operational practice, which uses calendar-based regulation schedules for the WCAs. Regulation schedules, also referred to as rule curves, or flood control schedules, typically specify the release rules for a WCA based on the water level at one or more key gages. Regulation schedules do not typically contain rules for importing water from an upstream source. The regulation schedules also repeat every year and make no allowance for interannual variability. The rain-driven operational concept includes rules for importing and exporting water from the WCAs in order to mimic a desired target stage hydrograph at key locations within the Everglades system. The target stage hydrographs mimic an estimate of the predrainage Everglades water level response to rainfall.

Analysis of incremental runs performed as part of the LEC regional water supply planning process indicate that rain-driven operations for WCAs 2B, 3A, 3B, and Everglades National Park could be developed and implemented by 2005. The rain-driven operations for WCA-2A should be developed and implemented by 2010. The rain-driven operations are key to providing additional water when needed prior to construction of the major storage features recommended in the Restudy. The schedules need to be updated as major storage features are constructed or at least every five years. Additionally, a methodology to transform concepts applied during regional model simulations to rainfall formulas that can be applied during daily operation of the Central and Southern Florida Project for Flood Control and Other Purposes (C&SF Project) should be developed by

2003. WCA-1 is recommended to retain its latest regulation schedule until comprehensive analysis be undertaken to determine whether a future rain-driven schedule will be beneficial.

Recommendation 27: Change Coastal Wellfield Operations

Shifting demands from eastern facilities to western facilities, away from the saltwater interface, was recommended for some coastal public water supply utilities in the LEC Planning Area, which are expected to experience an increased threat of saltwater intrusion. The Restudy recommended that a portion of demand should be shifted inland for the following utilities: Riviera Beach, Lake Worth, Lantana, Manalapan, Boca Raton, and Florida City. The volume shifted depended upon the degree of saltwater intrusion, but is generally proportional to the increase in demands between the 1995 existing conditions and the projected 2050 future without plan conditions. Eastern wellfields at Miramar, Hollywood, Broward County 3A, 3B, and 3C, Dania Beach, and Hallandale are assumed to be on standby with the entire demand met from western facilities.

The coastal wellfield operations evaluated as part of the LEC Plan indicate that fewer utilities and less demand may need to be shifted inland or to alternative sources of water to avoid an increased threat of saltwater intrusion. The wellfields that continue to indicate an increased threat of saltwater intrusion or that may not be able to meet a 1-in-10 year level of certainty in 2020 are Lantana, Lake Worth, Manalapan, Boca Raton, Broward 3A, 3B, and 3C, Hollywood, Dania Beach, Hallandale Beach, North Miami, and North Miami Beach. Their projected 2020 demands may not be able to be met at their current wellfield locations. Additionally, the incremental runs of 2005, 2010, and 2015 indicated superior performance when utilizing the same wellfield distribution in LEC-1. To meet the 1-in-10 year level of certainty and reduce the threat of saltwater intrusion in the near-term, the identified demands may need to be shifted from coastal wellfields as soon as possible. The individual utilities may consider other water supply options and the District is proposing a water resource development project in which the utilities in southeastern Broward County cooperatively develop additional wellfield and treatment capacity.

Recommendations to the CERP from the CWMP

The Caloosahatchee Water Management Project (CWMP) identified the need for storage within the basin using a regional optimization approach with underground storage of such amount that the ASR systems will tolerate extended withdrawals of 220 MGD and 220,000 ac-ft in aboveground storage (reservoirs plus other storage options). The analysis in the CWMP indicates that more detailed evaluation using more site-specific information may result in changes to the sizing and combination of this storage and recommends that the detailed evaluation be continued as part of the Southwest Florida Study (SWFS).

Five types of potential storage options or components were identified: regional and distributed reservoirs, ASR, backpumping to Lake Okeechobee, in-river storage due to structure S78.5, and water table harvesting. The five storage components were combined into nine alternatives that were evaluated utilizing reduced flows from Lake Okeechobee

as modeled in the LEC 2020 with Restudy alternative simulation. Of these components, model results indicate that backpumping has limited utility or benefit and, therefore, is not practical, based on the assumptions in the CWMP. Addition of a structure in the Caloosahatchee River (S78.5) and water table management showed minimal benefit, but may be considered as part of an overall storage strategy. Regional and distributed reservoirs and ASR systems showed the greatest potential for meeting the storage needs in the Caloosahatchee Basin and are recommended for additional investigation and pilot testing within the basin.

A detailed assessment of the potential storage components is needed to identify a preferred alternative for meeting the demands in the Caloosahatchee Basin in 2020. It is recommended that the detailed assessment be completed as a part of the implementation of the SWFS.

The modeling conducted, as part of the CWMP, to evaluate the performance of various storage components utilized revised Caloosahatchee Basin hydrology and demands from those used in the Restudy. This assessment showed higher demands and lower runoff from the basin, and consequently less water was available to be placed in storage. The CWMP evaluated options that focused on additional storage within the basin coupled with limited water supply deliveries (matching the results of the Restudy) from Lake Okeechobee. Under these assumptions the proposed water supply backpumping option performed poorly. It is recommended that the SWFS and the analysis by the CERP RECOVER process further investigate the recommendations of the CWMP concerning in-basin storage and backpumping for storage in Lake Okeechobee (coupled with reasonable assurances of adequate deliveries from the lake to the Caloosahatchee Basin) to confirm the best combination that meets the cost-effectiveness, water supply, and environmental goals recommended in the Restudy for the Caloosahatchee Basin.

The SWFS needs to be completed and implemented to address freshwater discharges to the Caloosahatchee Estuary and increase surface water availability for water use. The recommendations of the CWMP and the Restudy, and associated funding, should be pursued after detailed modeling is performed.

An evaluation of projected flows to the Caloosahatchee River was conducted via the LEC Plan and the CWMP for 1990 and 2020 base case conditions. The results of these evaluations indicate that the proposed MFL criteria and the restoration base flow needs of the Caloosahatchee Estuary are not being met. Pursuant to the direction provided in Section 373.042, F.S., a recovery plan is provided in the LEC Plan. The recovery plan consists of design and construction of enhanced basin storage capacity using surface water, ASR, and reservoirs as described in the Restudy and refined through the CERP and SWFS.

Based on the recommended development of water management and storage infrastructure to effectively capture and store the surface water flows in the Caloosahatchee Basin, the projected surface water needs of the basin and the estuary can be met. Supplemental agricultural demands from surface water sources within the basin are estimated to increase from 230,000 ac-ft per year (200 MGD) based on 1995 land use,

to approximately 320,000 ac-ft per year (285 MGD) on average based on 2020 projected land use. Public water supply needs from the Caloosahatchee River are projected to increase from 13,000 (12 MGD) in 1995 to 18,000 ac-ft per year (16 MGD) on average by 2020. The environmental needs of the Caloosahatchee Estuary have been estimated at 450,000 ac-ft (400 MGD) while average flows to the estuary are estimated to be approximately 650,000 ac-ft per year (580 MGD) on average. Flow to the estuary in excess of needs can, therefore, be as high as 200,000 ac-ft per year (180 MGD) on average, that is adequate, to meet increased demand through 2020. It was also concluded that the evaluated components, once constructed, would be adequate to meet the demands in the basin during a 1-in-10 year drought event.

The CWMP has identified that the future environmental, agricultural, and public water supply needs of the Caloosahatchee Basin and Estuary can be met from a combination of basin storage options with deliveries of water from Lake Okeechobee as identified in the South Florida Water Management Model (SFWMM) LEC 2020 with Restudy components. The evaluation of storage components conducted as part of the study show that components capable of providing short-term and long-term storage are required. The finding suggests that regional and distributed reservoirs, as well as ASR systems, would form an integral part of any successful storage development within the basin. A pilot testing program should be developed to verify the feasibility and effectiveness of these storage methods within selected sites in the Caloosahatchee Basin through the SWFS.

Recommendation 28: Caloosahatchee River ASR Pilot Project

Discussion

The District should work cooperatively with the USACE to site, design, construct, and operate a pilot regional ASR project. Recovery performance and additional information obtained from the construction of and cycle testing at this facility will guide the design of the regional ASR wellfield.

Summary Information

Cost: \$2,998,000 (SFWMD portion only)

Funding Sources: SFWMD and USACE

Implementing Agencies: SFWMD and USACE

Table 95. Estimated Schedule and Costs for the Implementation of the Caloosahatchee River ASR Pilot Project.^a

Recommendation	Plan Implementation Costs (\$1,000s)					
	FY01	FY02	FY03	FY04	FY05	Total 2005-2020
Caloosahatchee River Pilot ASR Project	250	2,300	280	84	84	2,998

a. Inkind service includes FTEs for design and implementation of the ASR Pilot Project and will be applied against the District's portion of the 50/50 cost-share requirement.

Recommendation 29: C-43 Basin Storage Reservoir and ASR Project

Discussion

The District should cooperate with the USACE in development of the Project Implementation Report (PIR), design, construction, and operation of a regional reservoir and ASR project within the Caloosahatchee Basin. A comprehensive geologic and geotechnical investigation should be completed, as a part of the PIR to provide the information needed to size and design the reservoir. Development of the PIR, land acquisition, design, and plans and specifications should be completed by 2005 and construction should be initiated in 2005.

Summary Information

Cost: \$138,094,000 (SFWMD portion only)

Funding Sources: SFWMD and USACE (50/50 cost share)

Implementing Agencies: SFWMD and USACE

Table 96. Estimated Schedule and Costs for the C-43 Basin Storage Reservoir and ASR Project.^a

Recommendation	Plan Implementation Costs (\$1,000s)					
	FY01	FY02	FY03	FY04	FY05	Total 2001-2005
C-43 Basin Storage Reservoir and ASR	2,154	2,163	23,925	66,386	43,466	138,094

a. Inkind service includes FTEs for design and implementation of the PIR and will be applied against the District's portion of the 50/50 cost share requirement.

Recommendation 30: Southwest Florida Study

Discussion

The District should work in cooperation with the USACE to initiate and complete the SWFS by 2005 as recommended in the CERP. The modeling work that has been completed as a part of the CWMP should be used as the basis for development of a preferred alternative to meet the demands within the Caloosahatchee Basin in 2020.

The primary purpose of the SWFS should be to provide a framework in which to address the health of aquatic ecosystems; water flows; water quality (including appropriate pollution reduction targets); water supply; flood protection; wildlife and biological diversity; and natural habitat. Evaluations involving surface water availability for water supply purposes should be based on providing a 1-in-10 year level of certainty from surface water as an optimal goal.

Subtasks

Task 30a. Complete problem identification/Project Study Plan phase by October 2000.

Task 30b. Complete development of a preferred alternative for the Caloosahatchee Basin by 2003.

Task 30c. It is recommended that the demand projections that were developed for the CWMP form the basis for evaluation of demands for the Caloosahatchee Basin in the SWFS.

Task 30d. The Integrated Surface Water Ground Water Model (ISGM) and other models that were developed to model the Caloosahatchee Basin should be incorporated into the SWFS and be utilized to evaluate the performance of water supply storage options, such as a distributed reservoir system. During the SWFS analysis, the CWMP demands and ISGM should be refined and updated as needed for evaluation of alternatives for meeting demands in the Caloosahatchee Basin in 2020.

Task 30e. Continue development of the modeling tools that were developed for the CWMP. These tools include the ISGM (MIKE SHE), Agricultural Field-Scale Irrigation Requirements Simulation (AFSIRS)/Water Balance Component (WATBAL), and optimization models that were developed for the Caloosahatchee Basin.

Task 30f. Continue the seepage study that was initiated during development of the CWMP.

Task 30g. The Plan of Study for the SWFS should include an evaluation of the feasibility of constructing a distributed reservoir system. In addition, the District should

investigate the feasibility of public/private partnerships for funding and implementing a distributed reservoir system.

Task 30h. In some areas immediately adjacent to the CWMP Planning Area, distributed, small-scale reservoirs could be developed that can offer improved water resource management through increased environmental and flood protection, and increased surface water resource availability. This should be investigated in the SWFS.

Summary Information

Cost: \$5-6,100,000 (estimated) (SFWMD portion only)

Funding Sources: SFWMD and USACE

Implementing Agencies: SFWMD and USACE (50/50 Cost Share)

Table 97. Estimated Schedule and Costs for the Southwest Florida Study.

Recommendation	Plan Implementation Costs (\$1,000s)					
	FY01	FY02	FY03	FY04	FY05	Total 2001-2005
Complete Southwest Florida Study	1,000	1,800	1,800	1,000	500	6,100

Operational Recommendations

Systemwide Operational Protocols and Periodic Operational Deviation Process

In addition to changes in the operation of the C&SF Project necessary to accommodate the future construction of proposed major water resource development features, revised systemwide operational protocols will be required in order to meet the increasing human and environmental water demands of the region over the next five to 10 years. Consistent operation of the C&SF Project in compliance with the revised systemwide operational protocols will be a critical factor in assuring projected water supply plan performance targets are met, and the expected water resource benefits to the region are provided.

It is also recognized that certain portions of the system may undergo periods of stress that are either unrelated to system operations or are caused, in part, by meteorological events which exhibit extreme high or low rainfall conditions that may exceed the design assumptions in the plan. A process which periodically reviews and recommends potential short-term deviations to the systemwide operational protocols are prudent. The process would be used to analyze the impacts of variations in weather and hydrologic conditions and identify opportunities for short-term operational deviations

which will offset, to some extent, the identified impacts. Therefore, it is desirable to include a measure of operational flexibility. This process will include public input and Governing Board approval prior to implementation. This process will complement the systemwide operational protocols by determining periodic operational deviations that could be applied to avoid or reduce potential impacts associated with extreme meteorological conditions.

District staff should reevaluate systemwide structure operations within the context of the proposed water supply plan assumptions. These systemwide operations will also need to be modified from time to time to take into account the construction of new water resource development projects. This reevaluation should incorporate the flexibility to facilitate short-term operational deviations to address extreme meteorological events or unanticipated negative ecological responses. This reevaluation should also incorporate the use of a wide range of environmental, water supply (e.g., ASR), flood control and water quality performance measures that can be used to make real time system operational decisions. Furthermore, the implementation of these new criteria should be accompanied with the development of statistical risk assessment procedures and other real time decision support tools.

Recommendation 31: Systemwide Operational Protocols

Discussion

The District needs to develop a comprehensive set of revised operational protocols that cover all of the existing components of the South Florida Water Resource Management System (SFWRMS). The SFWRMS covers the entire District area and includes the original components of the C&SF Project, as well as supplemental project structures constructed by the District and the Everglades Construction Project. Periodic operational revisions to this protocol through time will also incorporate future structures proposed by the District's water supply plans and the CERP. Furthermore, these protocols will implement recent and proposed programs and policies such as the following:

- MFLs
- Rain-Driven Deliveries to the Everglades
- Water Shortage Plan
- Water Supply Plan Elements
- Modified Water Deliveries Project
- C-111 Project
- Everglades Construction Project
- CERP
- Lake Okeechobee Construction Project

Operational criteria incorporates a number of interrelated elements into a comprehensive set of information that is used to develop real time operational strategies

and implement changes in structure operations in response to changing meteorological conditions:

Operational Goals and Objectives. To ensure successful operation of the SFWRMS, a set of goals and objectives, which are consistent with the water supply planning processes, is required. When exercising any available flexibility contained within the operational criteria, it is important to ensure that decisions on specific structure operations are focused to meet the stated objectives of the system. Therefore, a clear and concise set of goals and objects are critical to the successful implementation of the SFWRMS operational protocols.

Real Time Performance Measures. Performance measures are a critical component to the success of the overall water resource planning process. They are used as a means to evaluate and select a preferred water resource plan based on hydrologic simulations. Likewise, real time operations require a set of performance measures, consistent with the water supply planning processes, that can be used to insure the successful implementation of the selected plan. These real time measures can be used to identify problem areas and guide staff in the development of real time operational strategies that consider existing conditions in the context of changing meteorological and climatological outlooks. The performance measures should include success criteria for all significant environmental components, water shortage implementation, flood control management, and water quality assessment.

Decision Support. Real time operational decisions are predominantly risk-based assessments that utilize probabilistic estimates of rainfall and other relevant hydrologic and climatological conditions to develop the most prudent set of actions anticipated to meet the objectives of the water resource system. Therefore, a comprehensive decision support system that includes statistical position analysis tools, and other risk-based assessment protocols is required.

Flexible Operating Criteria. Criteria governing individual structure operations are the most basic element of any water resource operating system. Generally, these criteria are very specific and contain limited flexibility. The criteria developed in support of the original C&SF Project accepted that there would be few and relatively infrequent meteorological conditions that would impose serious environmental and socioeconomic impacts to the region. However, because of the state of technology available in the 1950s and 1960s, little could be done to foresee and react to environmental impacts that have driven much of today's efforts to improve the water resource system's performance. Future development of operational criteria must provide the capability to proactively react to rapidly changing climatological outlooks and environmental conditions. This flexibility should be guided by the goals and objectives of the various system element through the application of comprehensive performance measures. Decisions regarding changes in operations will require concurrence from the Executive Director and Governing Board depending on the situation. Public input should be frequently solicited on a periodic basis.

Subtasks

Task 31a. Complete the ongoing series of regional water supply plans through Governing Board approval

Task 31b. Develop public input process

Task 31c. Develop systemwide operational policies that meet the stated goals and objectives of the various programmatic efforts

Task 31d. Develop performance measures suitable for use in real time operational decisions, which incorporate environmental, water supply, flood control, and water quality elements

Task 31e. Develop a suite of decision support tools that incorporate a probabilistic, risk-based assessment methodology

Task 31f. Finalize systemwide operational policies

Task 31g. Conduct public workshops on the proposed operational alternatives and seek a Governing Board decision

Summary Information

Cost: \$0 (FTEs only)

FTEs: 5

Funding Source: SFWMD

Implementing Agency: SFWMD

Table 98. Estimated Schedule and Costs for Developing Systemwide Operational Protocols.

Recommendation	Plan Implementation Costs (\$1,000s and FTEs)											
	FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
Develop systemwide operational protocols		5										5

Recommendation 32: Periodic Operational Flexibility

Discussion

The District needs to develop a process to identify and implement short-term deviations to existing operational protocols that consider all of the existing and proposed components of the SFWRMS. These periodic operational deviations in process and review will cover the following geographic subregions:

- Upper Kissimmee Chain of Lakes
- Kissimmee River
- Lake Okeechobee
- Caloosahatchee River/Estuary
- St. Lucie River/Estuary
- Everglades
- Upper East Coast Planning Area
- LEC Planning Area
- Lower West Coast Planning Area
- Lake Okeechobee Service Area (LOSA)
- South Miami-Dade Agricultural Area
- Loxahatchee Slough and River
- Biscayne Bay
- Florida Bay

The regional hydrologic simulations were not structured to accurately consider short-term operational deviations that might be required to offset specific subregional environmental, water supply, flood control, or water quality situations. Therefore, a process to develop and implement short-term operational deviations must be initiated to ensure that every effort is made to meet the regional water resource goals in the next 20 years as the major elements of the LEC Plan and CERP are implemented. These deviations would be applied in a proactive manner utilizing long-range climate forecasts and real time performance measures. This flexibility will consider both high water and low water conditions, and include temporary modifications to the Supply-Side Management Plan for Lake Okeechobee. The development, implementation, and effectiveness of these deviations would be formatted by staff and, prior to implementation, discussed with the public and include periodic public workshops, Executive Office review, and Governing Board approval.

Subtasks

Task 32a. Review target performance measures of the subregion, compare them against actual performance, and, if stressed, determine probable cause, effect, and severity

Task 32b. Develop alternative short-term operational policies to evaluate the feasibility of various options that might be applied

Task 32c. Finalize a suite of alternatives and short-term operational policies

Task 32d. Coordinate with appropriate state and federal agencies

Task 32e. Conduct a public workshop on the proposed short-term operational alternatives and seek a Governing Board decision

Summary Information

Cost: \$0 (FTEs only)

FTEs: 12.5

Funding Source: SFWMD

Implementing Agency: SFWMD

Table 99. Estimated Schedule and Costs for Developing Periodic Operational Flexibility.

Recommendation	Plan Implementation Costs (\$1,000s and FTEs)											
	FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
Develop periodic operational flexibility		2.5		2.5		2.5		2.5		2.5		12.5

Recommendation 33: Lake Okeechobee Vegetation Management Plan

Over the last six years, extreme wet periods have resulted in abnormally high lake levels for long periods of time. These extreme high water levels have resulted in impacts to lake water quality, loss of important littoral zone vegetation communities, and have been reported to affect its sport fishery. The majority of scientists who have conducted research on the lake generally agree that a natural drought period or drawdown of the lake induced by man over the next several years would provide a number of ecological benefits to the ecosystem. These benefits would include improved water quality, reestablishment of damaged littoral zone habitat, and improved wildlife utilization of the littoral zone.

The only negative environmental issue associated with a potential drawdown of the lake over the next five years is the near certainty of torpedo grass and melaleuca expansion within upper elevations of the littoral zone. Currently, over 16,000 acres of torpedo grass infest the western littoral zone of the lake. These plants offer poor habitat for fish and wildlife due to their dense growth form and result in low oxygen levels within the water column. Researchers have speculated that if Moonshine Bay should become dry

(lake stages less than 11 ft NGVD) this would allow the rapid expansion of this introduced exotic throughout this pristine area of the lake (SFWMD, 2000e).

The first sweep of melaleuca control efforts have been made throughout most of the littoral zone, but viable seeds remain in seed banks and within remaining melaleuca stands. In comparison to torpedo grass, melaleuca poses less of a threat to the lake since it is currently under an advanced level of management and has a slower rate of expansion.

To address this issue, the LEC Plan recommends the formation of a Lake Okeechobee Vegetation and Fire Management Team (LOVFMT) that will work in cooperation with the existing South Florida Interagency Fire Management Council. It will be the responsibility of the LOVFMT to develop a Lake Okeechobee Vegetation Management Plan designed to manage torpedo grass and melaleuca expansion within the lake by providing increased opportunity for control of the invasive species in anticipation of dry periods. This plan would consist of organizing the LOVFMT to take advantage of future predicted low lake stages through a combination of burn management and disking programs designed to remove old growth, which renders the plant more susceptible to herbicide treatment.

The District in cooperation with the FDEP and the USACE will develop an approved work plan to deploy helicopters, spray boats, and herbicide field teams, as necessary, to conduct a large-scale torpedo grass and melaleuca eradication program within the western littoral zone of the lake (including Moonshine Bay) in the event the lake levels fall below 12 ft NGVD. This program will be implemented over the next five years to address the torpedo grass expansion problem and ensure that melaleuca will not become reestablished if the opportunity for low lake stages becomes eminent.

Summary Information

Cost: \$750,000 (District share only)

FTEs: 2.5

Funding Sources: SFWMD, FDEP, and USACE. Funding will be coordinated with the State of Florida's fire permitting agency (Division of Forestry, Florida Department of Agriculture and Consumer Services). It is estimated that total funding for this program from all sources for this effort would be about \$2.5 million.

Implementing Agencies: SFWMD, FDEP, and USACE

Table 100. Estimated Schedule and Costs for the Lake Okeechobee Vegetation Management Plan.

Recommendation	Plan Implementation Costs (\$1,000s and FTEs)											
	FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
Lake Okeechobee Vegetation Management Plan	150	0.5	150	0.5	150	0.5	150	0.5	150	0.5	750	2.5

Consumptive Use Permitting and Resource Protection Projects

Implementation of the LEC Plan through CUP and resource protection actions will take place consistent with Florida law, utilizing the assurances framework developed by the Governor's Commission for a Sustainable South Florida and included in the CERP.

As one of the tools for plan implementation, rulemaking to implement the regulatory recommendations of the LEC Plan will constitute a significant effort during the next several years. Rulemaking will include water reservations and numerous CUP criteria, which are interrelated and cumulatively define the availability of water for consumptive uses and water resource protection. As a result, it is recommended in the LEC Plan that certain rulemaking efforts be grouped in phases to allow for the cumulative analysis of the water resource and consumptive use implications of the regulatory program.

Another goal of the rulemaking schedule is to adopt rules as the technical information becomes available. As a result, it is recommended in this plan that initial rulemaking proceed for concepts that were sufficiently identified and evaluated in the planning process. These include establishment of MFLs for the Everglades, Lake Okeechobee, the Biscayne Aquifer, and the Caloosahatchee River.

In addition, uncertainties in the rulemaking process, such as delays for development of supporting technical data or rule challenges, may conflict with the proposed schedule for rule development provided in this plan. The proposed schedule will be adapted to account for such delays, while considering the need to develop associated rules through a coordinated rulemaking process. The contingency process identified in the plan, along with input from the LEC Regional Water Supply Plan Advisory Committee, other members of the public, and the Governing Board may be used to identify necessary changes to the rulemaking schedule.

Recommendation 34: Water Reservations

Discussion

Water reservations need to be established where necessary to assure the public of the availability of water specific to locations for the protection of fish and wildlife or protection of public health and safety based on the discussion in **Chapter 5**. In **Chapter 5**, a legal, policy, and technical description of reservations and necessary implementation actions is provided.

Subtasks

Task 34a. For all reservation locations, quantify water for reservation, based on incremental increases in water availability associated with the proposed implementation of water resource development projects; identify assumptions used in incremental reservation increases, including water resource development projects proposed to augment or create reservation water supplies;

identify a process for updating reservation rules in five-year increments if reservation-based assumptions are changed or prove to be inaccurate

Task 34b. Conduct rulemaking necessary to implement the reservations

Task 34c. Conduct additional research to identify freshwater flow needs and define reservation demands for the Biscayne Bay, Florida Bay, the Loxahatchee River, and subregional wetland systems in Broward and Palm Beach counties (**Table 101**)

Task 34d. Update the LEC Plan in 2005 to incorporate the projected reservation demands and to identify additional implementation measures for reservations

Table 101. Target Dates for Establishing MFLs and Reservation Rules.

Priority Water Body	Target Date for Establishment of MFL Rule	Target Date for Establishment of Reservation Rule
Lake Okeechobee	December 2000	NA
Water Conservation Areas	December 2000	December 2003
Holey Land and Rotenberger WMAs	December 2000	December 2003
Everglades National Park	December 2000	December 2003
Rockland Marl Marsh in Everglades National Park	December 2005	December 2005
St. Lucie Estuary	December 2001	December 2001
Caloosahatchee River and Estuary	December 2000	December 2000
Stormwater Treatment Areas	NA	March 2001
Loxahatchee River	December 2001	December 2001
Biscayne Bay	December 2004	December 2004
Florida Bay	December 2003	December 2003
Biscayne Aquifer	December 2000	NA
Southern Biscayne Aquifer	December 2003	NA
Subregional Wetlands	NA	December 2003

Summary Information

Cost: The initial reservation rulemaking will involve existing technical, regulatory, and legal staff at a total of 1.7 FTEs over the first two quarters of FY 2001. Additional research for the definition of reservations for Biscayne Bay, Florida Bay, the Loxahatchee River, and subregional wetland restoration, are funded under other initiatives in this plan. However, staff to support rulemaking for adoption of reservations for these additional areas is expected to be 0.5 FTEs by 2004. The \$125,000 estimated for the five-year duration of this program is directed towards the development of operation criteria for delivering the reservation water included in the rule(s).

FTEs: 1.7

Funding Source: SFWMD

Implementing Agency: SFWMD

Table 102. Estimated Schedule and Costs for Reservation of Water.

Recommendation	Plan Implementation Costs (\$1,000s and FTEs)											
	FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
Water Reservations	50	0.7		0.3			75	0.5		0.2	125	1.7

Recommendation 35: Establish MFLs

Discussion

Establish MFLs by rule by December 2000 for Lake Okeechobee, Everglades National Park, and the WCAs, the Biscayne aquifer (north of the C-2 Canal), and the Caloosahatchee River and Estuary. Develop and establish MFLs for the Loxahatchee River and St. Lucie Estuary by 2001, the southern Biscayne aquifer by 2003, and for Biscayne Bay by 2004. Funding and manpower estimates are associated with the rulemaking and peer review process only. Funding and manpower associated with data collection and research are incorporated as separate recommendations.

Subtasks

Task 35a. Complete research on Biscayne Bay, St. Lucie Estuary, and the southern coastal Biscayne aquifer

Task 35b. Finalize the MFL criteria development process

Task 35c. Incorporate proposed MFLs and recovery and prevention strategies into the rulemaking process consistent with the dates for establishment identified above (**Table 101**)

Task 35d. Conduct public workshops on rule language, notice draft rule with FAW, and seek Governing Board authorization of rule

Summary Information

Cost: \$80,000 over five years (peer review and rulemaking process only)

FTEs: 1.3

Funding Source: SFWMD

Implementing Agency: SFWMD

Table 103. Estimated Schedule and Costs for Establishing MFLs.

Recommendation	Plan Implementation Costs (\$1,000s and FTEs)											
	FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
Establish MFLs	40	0.5				0.3	40	0.5			80	1.3

Recommendation 36: MFL Criteria for the Rockland Marl Marsh

Discussion

Everglades National Park staff has suggested the proposed interim MFL criteria for the Rockland marl marsh within the park may not sufficiently protect these wetlands from significant harm. Additional wetland research is proposed to confirm or refine the MFL return frequency criteria that will not cause significant harm to marl-forming wetland plant and animal communities. As part of the LEC regional water supply planning process, the District, Everglades National Park, and USGS staff will jointly develop a work plan to conduct the necessary research needed to confirm or refine the proposed MFL return frequency criteria for the Rockland marl marsh. This work will also help to determine appropriate levels for reservations of water.

Subtasks

Task 36a. Select an interagency working group, with public input, to develop the Rockland marl marsh MFL research plan

Task 36b. Develop the draft research plan and have it independently peer reviewed by November 2001

Task 36c. Once the research plan has been approved, the District will include its portion of the cooperative agreement in its 2002 budget for Governing Board approval

Task 36d. Implement the research plan by September 2002 with a final report delivered to the District by July 2005

Summary Information

Cost: \$115,000

FTEs: 0.5

Funding Sources: SFWMD

Implementing Agencies: SFWMD, Everglades National Park, and USGS**Table 104.** Estimated Schedule and Cost for MFL Research for the Rockland Marl Marsh.

Recommendation	Plan Implementation Costs (\$1,000s and FTEs)											
	FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
MFL Research for the Rockland Marl Marsh	15	0.1	100	0.1		0.1		0.1		0.1	115	0.5

Recommendation 37: MFLs for Florida Bay**Discussion**

In response to recommendations made by Everglades National Park staff, Florida Bay was placed on the District's Priority Water Body List for establishment in 2003. A sufficiency review of the necessary technical information needed to develop MFLs for Florida Bay has been completed and is under review. A number of research projects are currently under way that will provide data for developing initial MFLs for Florida Bay. In addition, conceptual models of Florida Bay are being developed by the CERP RECOVER Team and may be used as a starting point for developing MFL criteria for Florida Bay. The District expects to develop initial MFL criteria for Florida Bay by 2003.

Subtasks

Task 37a. Complete the MFL sufficiency review for Florida Bay

Task 37b. Complete the work plan for Florida Bay MFL development

Task 37c. Utilize existing research programs to collect the necessary stage, flow, and salinity data needed to establish flow-salinity relationships for Florida Bay

Task 37d. Utilize existing salinity response information on seagrasses and evaluate high salinity response (up to 70 ppt) experiments in Key Largo mesocosms

Task 37e. Finalize the development of conceptual models and use them as a starting point for the development of MFL criteria for Florida Bay

Task 37f. Utilizing the above information, develop and publish initial MFL technical criteria for Florida Bay, and have this technical document peer reviewed by an independent scientific peer review panel by March 2003

Task 37g. Establish initial MFLs (Phase 1) for Florida Bay by December 2003. Identify minimum flows and/or levels needed to prevent significant harm, and identify

the amount of water needed to restore Florida Bay and establish a reservation of water to protect the ecosystem

Task 37h. Develop a Florida Bay water quality model and incorporate trophic level responses

Task 37i. Utilize water quality models to establish Phase 2 MFLs for Florida Bay

Summary Information

Cost: \$850,000

FTEs: 11.5

Funding Source: SFWMD

Implementing Agencies: SFWMD and Everglades National Park

Table 105. Estimated Schedule and Cost for MFLs for the Florida Bay.

Recommendation	Plan Implementation Costs (\$1,000s and FTEs)											
	FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
MFLs for the Florida Bay	200	2.5	250	2.5	150	2.5	125	2.0	125	2.0	850	11.5

Recommendation 38: MFL Recovery Strategies

Pursuant to the requirements of the MFL statute, analyses of current and future conditions were conducted for each of the priority water bodies where MFLs were defined. When the evaluation showed MFLs are not or will not be met in the future, recovery or prevention strategies, as appropriate, were developed. See **Chapter 5, page 227**, for a more detailed discussion of MFL recovery strategies.

Subtasks

Task 38a. Complete the design, permitting, and construction of CERP related long-term recovery strategies

Task 38b. Develop and implement operational protocols for releasing water from regional storage, as conditions warrant, to prevent the MFL criteria from being exceeded prior to implementation of long-term recovery measures. See **Recommendation 31** and **32** for more information.

Task 38c. Complete rulemaking that: a) defines regional water supply to coastal service areas during 1-in-10 year drought conditions consistent with environmental restoration and water resource development implementation schedules; b) addresses permit duration and limits on the amounts of reasonable new demands on regional water supply in five-year increments; c) establishes enhanced water conservation measures for water users; and d) establishes water reservations for the Everglades system.

Summary Information

Cost: \$200,000

FTEs: 1

Funding Source: SFWMD

Implementing Agencies: SFWMD

Table 106. Estimated Schedule and Cost for MFL Recovery Strategies.

Recommendation	Plan Implementation Costs (\$1,000s and FTEs)											
	FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
MFL recovery strategies	75	0.2	50	0.2	25	0.2	25	0.02	25	0.2	200	1.0

Recommendation 39: MFL Monitoring Systems

Discussion

Monitoring systems must be established in order to implement MFL recovery and prevention strategies and conduct research necessary to further refine the ability to project when significant harm could occur. The monitoring systems will collect water flow, water level, and water quality data. Monitoring data is necessary to affect interim operational strategies and to gage the success of MFL long-term recovery and prevention strategies.

Subtasks

Task 39a. Identify appropriate locations within the LEC planning area to establish a long-term MFL monitoring network. Review and evaluate the location of current water management gages. Relocate and/or install appropriate lake, estuary, marsh, and canal gaging stations and associated telemetry within each identified MFL priority water body

Task 39b. Develop an interactive database to collect and store MFL data that will provide water managers with real time information that can be used to make operational decisions

Task 39c. Conduct field and laboratory research and monitoring programs designed to evaluate the effects of implementing the proposed MFL criteria proposed as part of this plan. Include both long-term and short-term projects that will evaluate the effects of the proposed criteria at scales ranging from laboratory studies to field monitoring at specific sites. Provide summaries of the results of this research for incorporation into the next update of the LEC Plan.

Summary Information

Cost: \$550,000

FTEs: 1.5

Funding Source: SFWMD

Implementing Agencies: SFWMD

Table 107. Estimated Schedule and Cost for Establishing a MFL Monitoring System.

Recommendation	Plan Implementation Costs (\$1,000s and FTEs)											
	FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
Establish a MFL Monitoring System	50	0.2	200	0.4	200	0.5	50	0.2	50	0.2	550	1.5

Recommendation 40: Consumptive Use Permitting, Rulemaking, and Resource Protection Projects

Discussion

The District will continue conducting the rule development and rulemaking processes for the subjects listed in **Chapter 5** in the section on **Consumptive Use Permitting and Resource Protection Projects**. These concepts are conceptually laid out in a series of white papers produced in 1999¹ and Districtwide rule development workshops were conducted on these rule concepts in February 1999.

Subtasks

Task 40a. Develop draft rules for public review

1. These white papers can be obtained by contacting the District's Office of Counsel.

Task 40b. Conduct rulemaking workshops

Task 40c. Revise draft language per public comments and Governing Board direction in order to produce a final draft of the rule

Task 40d. Notice final draft of the rule in FAW and schedule Governing Board adoption of the final draft rule in the fall of 2000¹

Task 40e. Modify ground water models for application to the CUP review process.

Summary Information

Cost: \$0

FTEs: 0.5

Funding Source: SFWMD

Implementing Agency: SFWMD

Other Water Resource Projects

Recommendation 41: Comprehensive Water Conservation Program

Discussion

The District will develop and implement a comprehensive water conservation program to cultivate a conservation ethic in cooperation with water users, utilities, and local governments to promote water conservation and more efficient use of the water resources in the LEC Planning Area. The conservation program will incorporate continued development and compliance with water conservation ordinances, development and implementation of public education programs, use of alternative water sources, other conservation methods, and document new and existing water conservation efforts. The conservation program will encompass all uses, but should provide emphasis on the outside use of water and Xeriscape™ principles. This program and position will be implemented Districtwide and focus on urban areas and outdoor uses.

The creation of a water conservation coordinator position and provisions for fiscal incentives are envisioned as potential tools to establish the water conservation plan. This position will be created from an existing position. It will focus on the development of a comprehensive water conservation program and establishment of a strong water conservation ethic. The coordinator will also assist water users and utilities to further public education and to develop their own customized water conservation program and establish numeric efficiency goals that are cost-effective and achievable.

1. The schedule for rule adoption will be subject to possible third party challenges and concerns.

Subtasks

Task 41a. Redirect an existing position to a water conservation coordination position

Task 41b. Develop a comprehensive conservation plan in cooperation with water users, utilities, and local governments, including development of a goal and objectives, by September 2001, capable of the following:

- Identification of inefficiencies in water use
- Identification of projects and programs to improve water use efficiency through incentive and regulatory approaches
- An evaluation of the effectiveness of various options in meeting the existing and projected needs of the project area
- Identification of specific conservation measures that should be incorporated in the update to this plan
- Development and implementation of public education programs
- Assistance to local governments in development of water conservation ordinances, land use regulations, and compliance programs
- Optimization of use of the CUP Program and Development of Regional Impacts (DRI) review abilities to implement conservation

Task 41c. Identification of cost sharing or incentive programs

Task 41d. Development of numeric efficiency goals for each major user/project area

Summary Information

Cost: \$250,000 per year for 2001-2004 (LEC Planning Area portion only)

FTEs: 3.75 (75 percent of Districtwide total)

Funding Source: SFWMD

Implementing Agency: SFWMD

Table 108. Estimated Schedule and Costs for the Conservation Program.^a

Recommendation	Plan Implementation Costs (\$1,000s and FTEs)											
	FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
Redirect evaluator/coordinator position	250	0.75	250	0.75	250	0.75	250	0.75		0.75	1,000	3.75

a. Costs associated with the Alternative Water Supply Funding Program are addressed in the funding section of this chapter.

Recommendation 42: Seawater Reverse Osmosis Treatment Facilities

The District will conduct a study to determine the feasibility of colocating seawater reverse osmosis treatment facilities with coastal electrical power plants located within the District. This technology may ultimately prove to be an alternative technology to the current sources under consideration in this plan. It could possibly provide significant volumes of drinking water at moderate cost. Because the water source (seawater) is not affected by seasonal weather conditions, it provides a secure and stable source of potable water even during drought events.

The cost-effectiveness of this alternative will be compared to CERP components such as reuse and conventional ground water withdrawal and treatment. If costs prove favorable, a recommendation to begin implementation of the technology will be included in a future LEC Plan update.

Subtasks

Task 42a. Review existing seawater Reverse Osmosis (RO) data

Task 42b. Identify potential power plants within the LEC Planning Area

Task 42c. Evaluate water quality considerations of source, product, cooling, and reject waters

Task 42d. Determine compatibility of the reject water and discharge location with existing surface water bodies

Task 42e. Identify site environmental issues

Task 42f. Identify potential users/partners of the product water in proximity of the RO plant.

Task 42g. Evaluate costs

Summary Information

Cost: \$250,000

FTEs: 0.5

Funding Source: SFWMD

Implementing Agencies: SFWMD with participation by interested public water utilities

Table 109. Estimated Schedule and Costs for a Feasibility Study for Reverse Osmosis Treatment of Seawater.

Recommendation Subtasks		Plan Implementation Costs (\$1,000s and FTEs)											
		FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
		\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
a	Review and evaluate existing seawater RO data, and operating costs of proposed Florida seawater RO facilities ^a												
b	Identify potential coastal power plants within District ^a												
c	Evaluate water quality considerations of source, product, cooling, and reject waters	50	0.1									50	0.1
d	Determine compatibility of the reject water and discharge location with existing surface water bodies	50	0.1									50	0.1
e	Identify site environmental issues	50	0.1									50	0.1
f	Identify potential users/ partners of the product water in proximity of the RO plant	50	0.1									50	0.1
g	Evaluate cost			50	0.1							50	0.1
	TOTAL	200	0.4	50	0.1							250	0.5

a. To be completed in FY2000

Recommendation 43: Reclaimed Water System in Northern Palm Beach County

This project will examine the feasibility of meeting the unmet future demands for irrigation water in northern Palm Beach County and coastal Martin County by conveying reclaimed water from central Palm Beach County. If determined feasible, an implementation project will be included when this plan is updated.

The District anticipates assuming the role of establishing the capital facilities to transport irrigation quality reclaimed water for private/public distribution and sale in areas of northern Palm Beach County and coastal Martin County. Local utilities will develop the end user distribution network and sale of the water.

Subtasks

Task 43a. Develop a Statement of Work (SOW) to conduct feasibility analysis with input from representatives of local utilities and users

Task 43b. Conduct an evaluation with local governments to determine feasibility of establishing building regulations for hookup where appropriate

Task 43c. Contract feasibility analysis

Task 43d. Review results of feasibility analysis and identify preferred alternative with input from representatives of local utilities and users

Summary Information

Cost: \$250,000

FTEs: 0.3

Funding Sources: SFWMD, water users, and utilities in Palm Beach and Martin counties

Implementing Agency: SFWMD

Table 110. Estimated Schedule and Costs to conduct a Feasibility Study for a Reclaimed Water System for Northern Palm Beach County.

Recommendation Subtasks		Plan Implementation Costs (\$1,000s and FTEs)											
		FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
		\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
a	Develop SOW	50	0.1									50	0.1
b-c	Conduct feasibility analysis			100	0.1							100	0.1
d	Review results of feasibility analysis					100	0.1					100	0.1
	TOTAL	50	0.1	100	0.1	100	0.1					250 ^a	0.3

a. Costs for implementation to be determined in the feasibility study

Recommendation 44: Indirect Aquifer Recharge

Discussion

The feasibility of recharging primary or secondary canals with wastewater treated to Advanced Wastewater Treatment (AWT) standards in conjunction with a cooperative utility will be explored. The focus of this project will be on issues not currently considered in related CERP projects. If economical feasibility is found, a pilot project will be recommended in the update of this plan. Success of the pilot project will ultimately lead to the development of full-scale projects throughout the region.

This source of water is expected to reduce the dry season demands on the regional system and serve as a source of water for recharging ground water and/or meeting local environmental demands. The project will be developed to identify and address regulatory requirements to move this use of water forward. FDEP will be part of the project team seeking to determine the appropriate treatment and timing of reclaimed water use. The reclaimed water recharge sources would be used only during dry conditions. Alternative, environmentally accepted disposal methods will continue to be necessary during the wet season.

Subtasks

Task 44a. Form interagency project team consisting of the FDEP, Broward, Palm Beach, and Miami-Dade counties, and the District

Task 44b. Identify data collection needs

Task 44c. Collect data

Task 44d. Determine feasibility

Summary Information

Cost: \$250,000

FTEs: 0.3

Funding Sources: FDEP, SFWMD, county, or utility

Implementing Agencies: FDEP, SFWMD, county, or utility

Table 111. Estimated Schedule and Costs for the Aquifer Recharge Study.

Recommendation	Plan Implementation Costs (\$1,000s and FTEs)											
	FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
Aquifer Recharge Study	100	0.1	100	0.1	50	0.1					250 ^a	0.3

a. Implementation costs will be determined by the study

Recommendation 45: High Volume Surface Water ASR Testing in Taylor Creek

Discussion

Currently the only ASR well with an USEPA authorized, aquifer exemption covering primary water quality parameters is owned by the District and is located by Taylor Creek in Okeechobee County. The well was permitted, constructed, and tested at a capacity of five-MGD during the late 1980s. Results of that testing suggest the mid-Floridan aquifer may be capable of receiving and storing surface water at much large injection rates than five MGD. It is recommended that the well be modified to support injection/recovery testing at rates of 20 MGD. The ability for wells constructed into the mid-Eocene portion of the Floridan aquifer to operate at 20 MGD versus five/ten MGD represents potential to save time and cost from the Lake Okeechobee ASR system recommended in the CERP.

The well is currently in disrepair and needs a FDEP underground injection operation permit, at a minimum, prior to additional testing. It is estimated that the cost to acquire permits, refurbish the well, and upgrade the pumping capacity would be \$750,000 and would take 12 months to complete. The costs to conduct the high capacity testing would be approximately \$100,000.

Subtasks

Task 45a. Conduct a baseline assessment of the well including compilation of all existing data, conduct a casing integrity test on the production well, determine the feasibility to proceed, and file applications for FDEP permits

Task 45b. Prepare specifications for well rehabilitation, injection pump upgrade, and testing protocol

Task 45c. Contract for either construction or abandonment, based on above evaluations

Task 45d. Conduct high capacity testing

Task 45e. Incorporate results into CERP designs

Costs: \$900,000

FTEs: 0.7

Table 112. Estimated Schedule and Costs for High Volume Surface Water ASR Testing for Taylor Creek.

Recommendation Subtasks		Plan Implementation Costs (\$1,000s and FTEs)											
		FY01		FY02		FY03		FY04		FY05		Total 2001-2005	
		\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$	FTE
a	Baseline assessment	100	0.1									100	0.1
b	Prepare specifications	50	0.1									50	0.1
c	Construct facilities			700	0.1							700	0.1
d	High capacity testing					50	0.2					50	0.2
e	Incorporate results into CERP						0.2						0.2
TOTAL		150	0.2	700	0.1	50	0.4					900	0.7

WATER SUPPLY DEVELOPMENT PROJECTS

Some wellfields continue to indicate an increased threat of saltwater intrusion may not be able to meet a 1-in-10 year level of certainty in 2020. These are Lantana, Lake Worth, Manalapan, Boca Raton, Broward 3A, 3B, and 3C, Hollywood, Dania Beach, and Hallandale Beach. Their projected 2020 demands may not be able to be met at their current wellfield locations. Additionally, a few utilities may meet the 1-in-10 year level of certainty goal, but may not meet CUP criteria. These include Seacoast, Jupiter, Riviera Beach, Pompano Beach, Boca Raton, Miami-Dade's proposed South Regional and West wellfields, North Miami Beach, North Miami, and Homestead. The 2005, 2010, and 2015 incremental simulations indicated superior performance when utilizing the same wellfield distribution in the LEC-1 simulation. To meet the 1-in-10 year level of certainty and reduce the threat of saltwater intrusion in the near-term, the identified demands may need to be shifted from coastal wellfields. The individual utilities may consider other water supply options. Modeling confirmed that alternative sources are available. **Chapter 5** also identified quantities of water available for each water supply option. The analysis concludes that the water supply options can be considered a menu from which local water users can select a combination of sources to meeting their individual water needs.

Recommendation 46: Water Supply Development

The recommendation of this plan is that individual water users evaluate alternative water supply sources and select the alternative, or combination of alternatives, which best suits local conditions. The District will continue to evaluate consumptive uses for their impacts on both the regional system and local resources on a case-by-case basis.

RELATIONSHIP OF PROJECTS TO THE FIVE-YEAR WORK PROGRAM

The District is required to prepare a five-year water resource development work program every year. This report, submitted to FDEP, documents the District's progress in implementing water supply plan recommendations. The time frame for the work program is a five-year minimum. For each recommendation or strategy, the work program will provide the following information:

- The total cost to the District of the project
- An estimate of the amount of water to become available by implementation of a project
- Funding source(s)
- Implementing agency or agencies
- A summary of any changes to the recommendation since the plan was implemented
- Timetables

The recommendations in this plan have been incorporated into the *2000 Five-Year Water Resource Development Work Program*.

FUNDING

This section addresses the funding strategy and options for implementation of the LEC Plan. The approach takes into account the requirements of Chapter 373, F.S., feedback and comments from the LEC Regional Water Supply Plan Advisory Committee, and input from District staff. Chapter 373, F.S., requires water supply plans to include a funding strategy that is reasonable and sufficient to pay the costs of constructing or implementing all of the water resource development projects.

In general, the funding approach is divided into two major categories: water resource development and water supply development. The water resource development category addresses funding for projects that are primarily the responsibility of the District. Water supply development projects, on the other hand, are primarily the responsibility of local governments, utilities, and other water users. However, information is included on programs that target funding of water supply development projects in general.

Water Resource Development

Water resource development projects are generally regional in nature and are primarily the responsibility of the District. The water resource development projects for the LEC Planning Area were itemized earlier in this chapter. Pursuant to Chapter 373, F.S., each water management district governing board is required to include in its annual budget the amount needed for the fiscal year to implement water resource development

projects, as prioritized in its regional water supply plans. In addition to this plan, the District is also completing regional water supply plans for two other planning areas (Lower West Coast and Kissimmee Basin planning areas) while approaching the third year of implementation of the Upper East Coast Water Supply Plan.

Besides implementation of the water supply plans, the District is initiating implementation of the \$7.8 billion CERP, a cost-shared effort with the USACE. It is anticipated that most of the District's financial resources will be used for this project. The Florida Legislature passed the Everglades Restoration Investment Act of 2000, enacting the Governor's proposal for CERP funding. An independent state process has been created under Section 373.1501, F.S., for authorizing CERP projects at the state level. A five-year funding plan will be established and administered by FDEP.

Current ongoing projects may qualify for a portion of the Districts funding responsibilities through the identification as in-kind contributions. It is not known, at this time, the impact that these efforts will have on the District's resources in the future. Consequently, this plan is unable to commit to implementation strategies beyond the current budget year. The recommendation tables in the plan show the costs of the projects and potential sources of funding. Furthermore, taxing strategies exist that have not been implemented or identified as potential sources of funding. Time frames for completing the projects are preliminary and are subject to funding availability in the future years.

Total cost to the District of the water resource development projects for this plan is dollars plus FTEs. The traditional funding source for these types of projects has been primarily ad valorem taxes. The non-CERP projects (most of those listed in this plan) will be ranked and prioritized along with projects in all other regional water supply plans during the annual District budget preparation, and funded as money is available. Priority considerations for a project include availability of a cost-share partner and if a project makes new water available. Sustainability of the regional system is also an important consideration of project prioritization.

Some of the recommendations in this plan are studies. These studies may result in construction projects at a later date. Funding associated with these will be addressed at that time. Potential funding sources for water resource development include funds provided on a project-by-project basis by the District's budget.

Water Supply Development

Water supply development projects are local in nature and generally involve the withdrawal, treatment, and distribution of water. Chapter 373 states that, "local governments, regional water supply authorities, and government owned and privately owned water utilities take the lead in securing funds for and implementing water supply development projects. Generally, direct beneficiaries of water supply development projects should pay the costs of the projects from which they benefit, and water supply development projects should continue to be paid for through local funding sources." It is not the intent that regional water supply plans mandate actions to be taken by local

agencies, utilities, and other water users. Therefore, the overall theme of this section is to provide direction and assistance, but not to mandate directives to local governments or utilities.

Chapter 373 requires water supply plans to identify potential sources of funding for water supply development projects. In addition to funding the projects through utility rates, several other funding programs exist to assist local entities.

Water Resource Protection and Restoration Projects Funding Program

On January 18, 2000, Governor Jeb Bush announced his proposal to finance the protection and preservation of Florida's water resources. The Governor's approved budget provides \$73 million to fund water resource restoration projects, which include wastewater treatment plant upgrades and STAs. This represents an increase of 38 percent over last year's water project funding.

Projects eligible for the funding must address such criteria as resolving violations of state water quality standards, preventing drainage and flood control problems, and resolving public health threats. Projects requesting funding for surface water restoration and wastewater improvements will be reviewed by the Water Advisory Panel to ensure eligibility.

The Governor created the Water Advisory Panel to ensure that efforts to protect and preserve Florida's water resources is priority-driven, objective, and policy-based. Projects determined by the panel as meeting the criteria will be forwarded to the Florida Legislature for funding consideration. This process ensures that state dollars are providing needed and meaningful improvements to state water resources.

The featured project must be identified in a water management district or FDEP plan as part of a surface water restoration effort. In addition, storm water related restoration projects that have a flood component must be identified in a storm water mitigation master plan and have quantifiable flood protection targets. For wastewater facilities projects, grant recipients must have, or agree to adopt, an ordinance requiring mandatory waste management hookup upon failure of individual systems. The sponsor, or recipient, of the wastewater facilities projects is expected to fund at least 25 percent of the total project costs.

Alternative Water Supply Grant Program

Vastly increased demands on natural supplies of fresh water led the Florida Legislature in 1995 to enact the Alternative Water Supply Grant Program to increase the potential for the development of alternative water supplies in the state; help utilities develop cost-effective reclaimed water supplies; and fulfill a public purpose to fund such programs. Since FY 1997, the District has funded 82 projects in its Water Resource Caution Areas (WRCAs) for a total of approximately \$20 million.

The Alternative Water Supply Grant Program is a cost-share program which provides a portion of funding for alternative water supply projects built by local, county, or private water purveyors. Since FY 1997, the District has provided funds for projects that save or offset millions of gallons of water everyday.

To be considered for this funding support, the project must be consistent with local government plans and must be located in a WRCA. The local government must require all appropriate new facilities within the project service area to connect and use the project's alternative water supplies. Funding support shall be applied only for the capital or infrastructure costs for the construction for alternative water supply systems and the project must fall within guidelines established by the District. The LEC Plan recognizes the importance of this program in meeting the future needs of the region.

Drinking Water State Revolving Fund Program

The 1996 Amendments to the Safe Drinking Water Act authorized USEPA to award grants to states for capitalization of Drinking Water State Revolving Funds. These are intended to be a source of financial assistance to public water systems to achieve compliance with Drinking Water Regulations and protecting public health. States must provide matching funds equal to at least 20 percent of the grant.

The Drinking Water State Revolving Fund Program consists of two elements. The first element is establishment of a loan fund enabling a state to make below-market loans to public water systems for the construction of projects (a public water supply utility can be publicly or privately owned, but some states have statutory or constitutional restrictions limiting funding for privately owned systems). States must adopt a priority system, ranking projects based on considerations of public health, compliance, and affordability, and are required to fund to the maximum extent practical in priority order. The second element is the ability to set aside money to assist public water supply in meeting regulatory requirements through direct assistance, loans, and/or state grants funding capacity development, source water assessment, source water protection, and operator certification.

SUMMARY OF RECOMMENDATIONS

Table 113 summarizes the costs of the recommendations. Each water resource development project has a projected start and finish date as shown in **Figure 36**.

Table 113. Costs of Recommendations by Fiscal Year (\$1,000s).

Recommendation		FY2001	FY2002	FY2003	FY2004	FY2005	Total 2001-2005	Total 2006-2020	Total 2001-2020
Ongoing Projects from the LEC Interim Plan									
1	Regional Saltwater Intrusion Management	130	235	240	216	152	973	2,280	3,253
2	Floridan Aquifer System Ground Water Model	125	75	210	85	60	555	a	a
3	Northern Palm Beach County Comprehensive Water Management Plan	881	455	855	400		2,591	a	a
4	Eastern Hillsboro Regional ASR Pilot Project	1,500	170				1,670	a	a
5	Hillsboro (Site 1) Impoundment Pilot Project	2,220	800	300	100		3,420		3,420
6	Lake Worth Lagoon Minimum/Maximum Flow Targets	100					100	a	a
7	Northern Broward County Secondary Canals Recharge Network	150	550	600	600		1,900	a	a
8	Southeast Broward County Interconnected Water Supply System	300	50	50			400	a	a
9	Broward County Urban Environmental Enhancement	100	50	50			200	a	a
10	Miami-Dade Water and Sewer Department Utility ASR	1,500	1,500	1,500	1,500	1,500	7,500	12,000	19,500
11	Biscayne Bay Minimum and Maximum Flow Targets	200					200	a	a
	Subtotal	7,206	3,885	3,805	2,901	1,712	19,509	14,280	33,789
Other Federal, State, or District Projects									
12	Critical Projects	2,130	2,115				4,245	a	a
13	Well Abandonment Program (Recommendation from the CWMP)	b	b	b	b	b	b	b	b
14	Saltwater Influence at S-79 (Recommendation from the CWMP)	b	b	b	b	b	b	b	b
15	Permitting Issues Associated with ASR Systems and Reuse of Reclaimed Water	b	b	b	b	b	b	b	b
16	Mobile Irrigation Labs	b	b	b	b	b	b	b	b
	Subtotal	2,130	2,115				4,245		
CERP Projects (Nonfederal Share)									
17	CERP in the LEC Planning Area	75,112	182,510	228,399	139,280	120,927	746,228	2,335,964	3,082,192
18-27	LEC Recommendations to CERP	b	b	b	b	b	b	b	b
28-30	CERP in the Caloosahatchee Basin/CWMP Recommendations to CERP	3,404	6,261	26,004	67,470	44,050	147,189	122,735	269,924
	Subtotal	78,516	188,771	254,403	206,750	164,977	893,417	2,458,699	3,352,116
Operational Projects									
31	Systemwide Operational Protocols	b	b	b	b	b	b	b	b
32	Periodic Operational Flexibility	b	b	b	b	b	b	b	b

Table 113. Costs of Recommendations by Fiscal Year (\$1,000s). (Continued)

Recommendation		FY2001	FY2002	FY2003	FY2004	FY2005	Total 2001-2005	Total 2006-2020	Total 2001-2020
33	Lake Okeechobee Vegetation Management Plan	150	150	150	150	150	750	a	a
	Subtotal	150	150	150	150	150	750		
Consumptive Use Permitting and Resource Protection Projects									
34	Water Reservations	50			75		125	a	a
35	Establish MFLs	40			40		80	a	a
36	MFL Criteria for the Rockland Marl Marsh	15	100				115	a	a
37	MFLs for Florida Bay	200	250	150	125	125	850	a	a
38	MFL Recovery Strategies	75	50	25	25	25	200	a	a
39	MFL Monitoring Systems	50	200	200	50	50	550		550
40	Consumptive Use Permitting, Rulemaking, and Resource Protection Projects	b	b	b	b	b	b	b	b
	Subtotal	430	600	375	315	200	1,920		1,920
Other Projects									
41	Comprehensive Water Conservation Program	250	250	250	250		1,000	a	a
42	Seawater Reverse Osmosis Treatment Facilities	200	50				250	a	a
43	Reclaimed Water System in Northern Palm Beach County	50	100	100			250	a	a
44	Indirect Aquifer Recharge	100	100	50			250	a	a
45	High Volume Surface Water ASR Testing in Taylor Creek	150	700	50			900	a	a
46	Water Supply Development	b	b	b	b	b	b	b	b
	Subtotal	750	1,200	450	250		2,650		2,650
TOTAL		89,132	196,771	259,183	210,366	167,039	922,491	2,472,979	3,395,470

a. Long-term cost projections dependent on the LEC Plan update in Fiscal Year 2005.

b. No District costs other than FTEs.

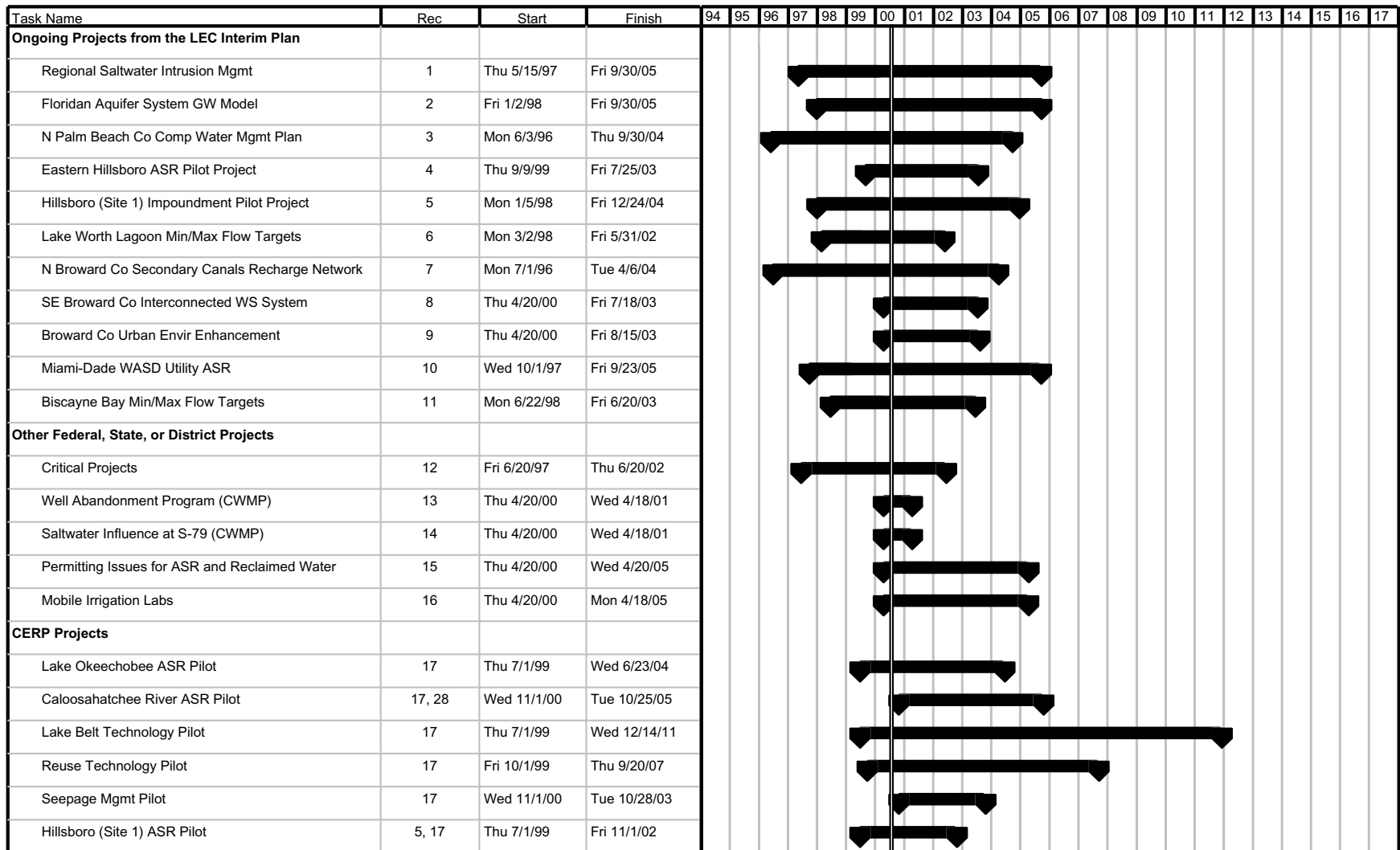


Figure 36. Implementation Schedule for the Recommendations made within the LEC Plan.

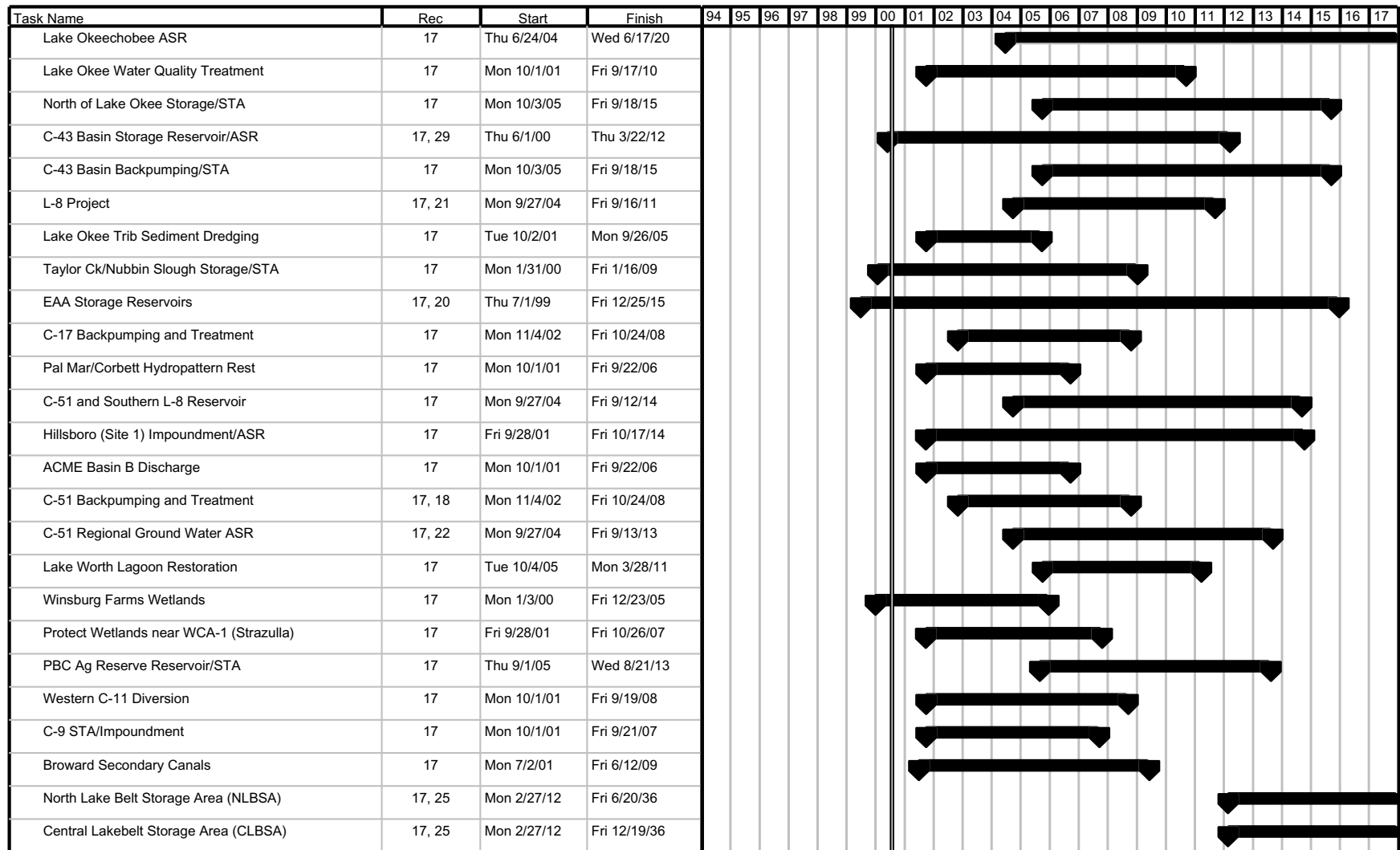


Figure 36. (Continued) Implementation Schedule for the Recommendations made within

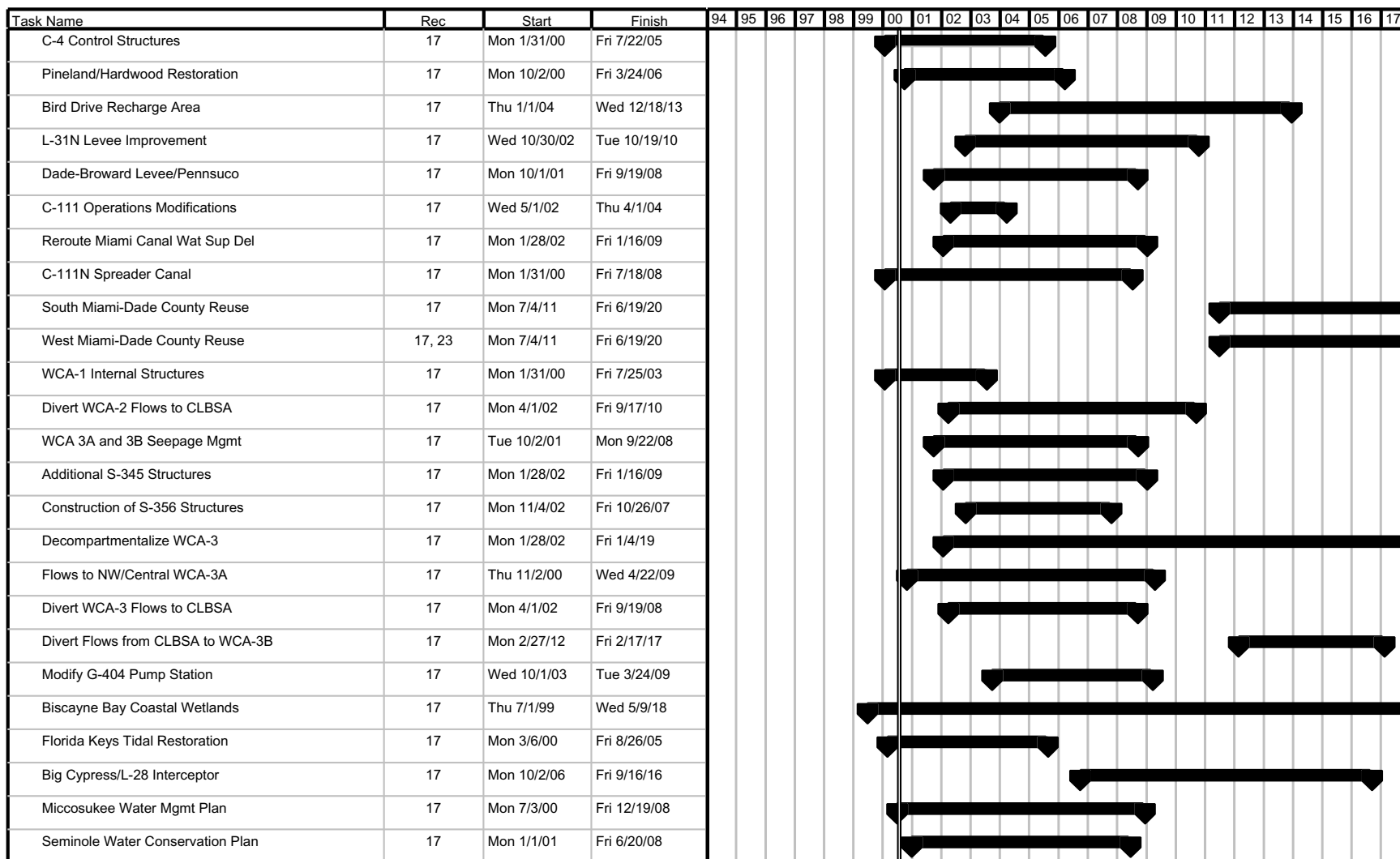


Figure 36. (Continued) Implementation Schedule for the Recommendations made within

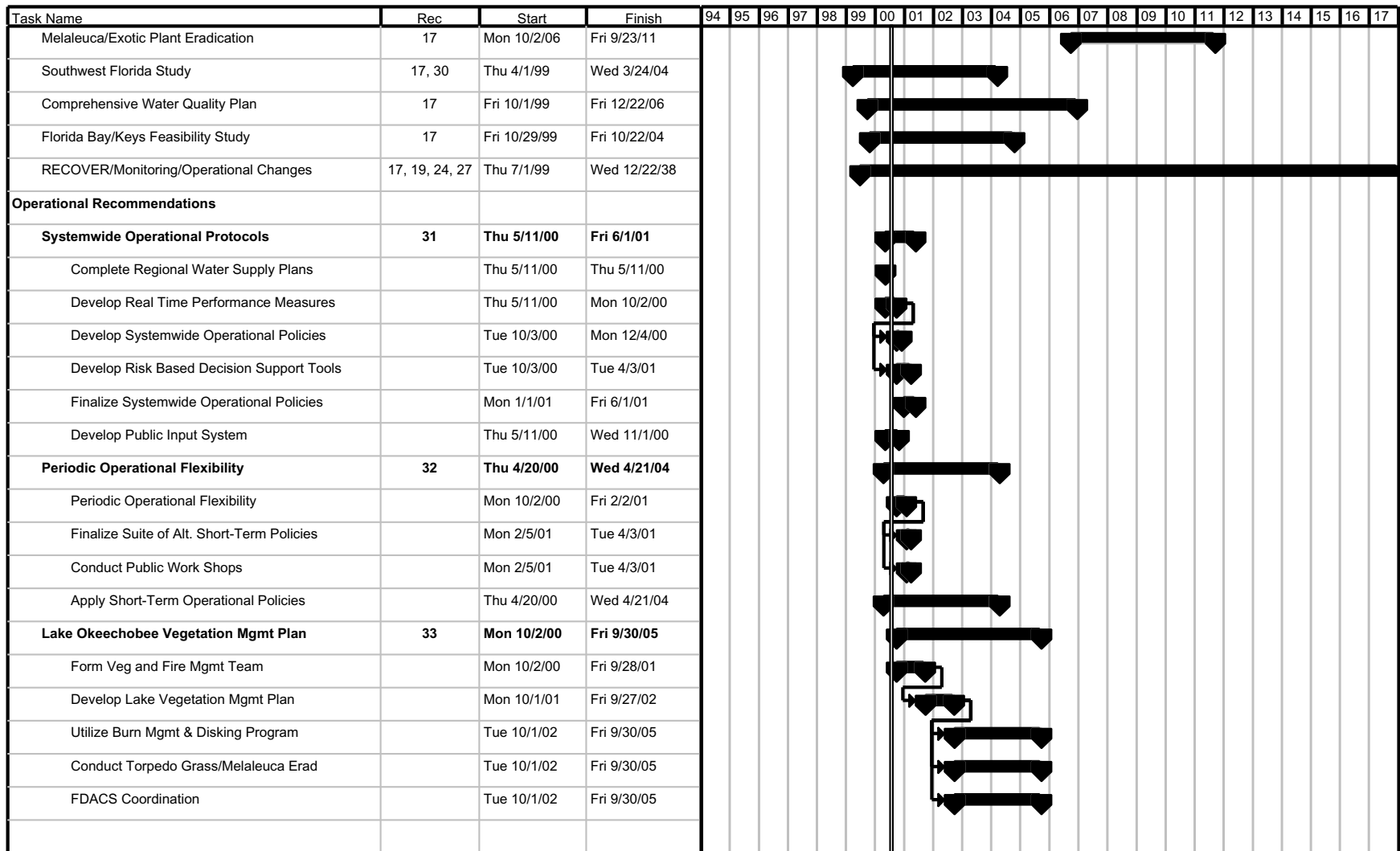


Figure 36. (Continued) Implementation Schedule for the Recommendations made within

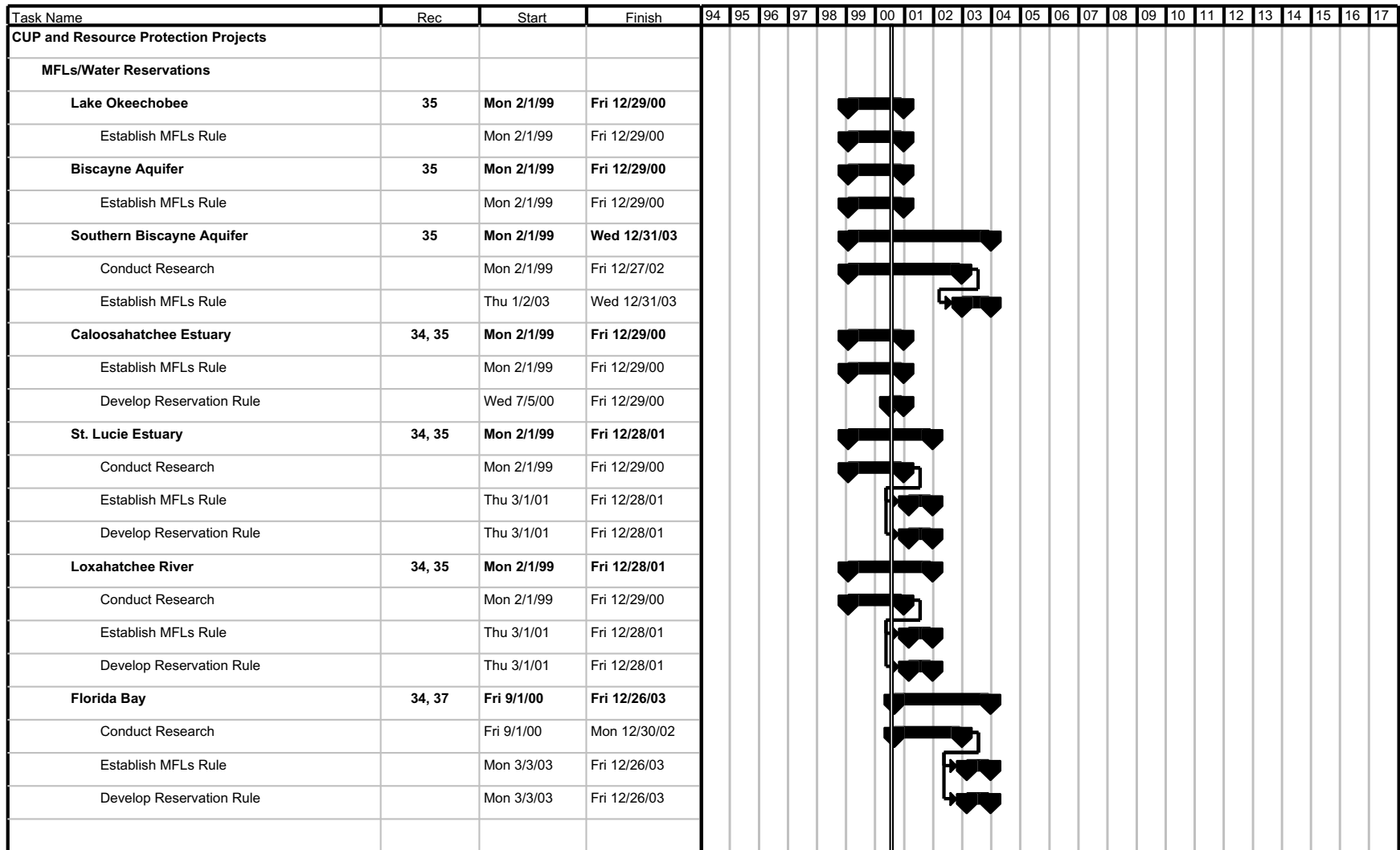


Figure 36. (Continued) Implementation Schedule for the Recommendations made within

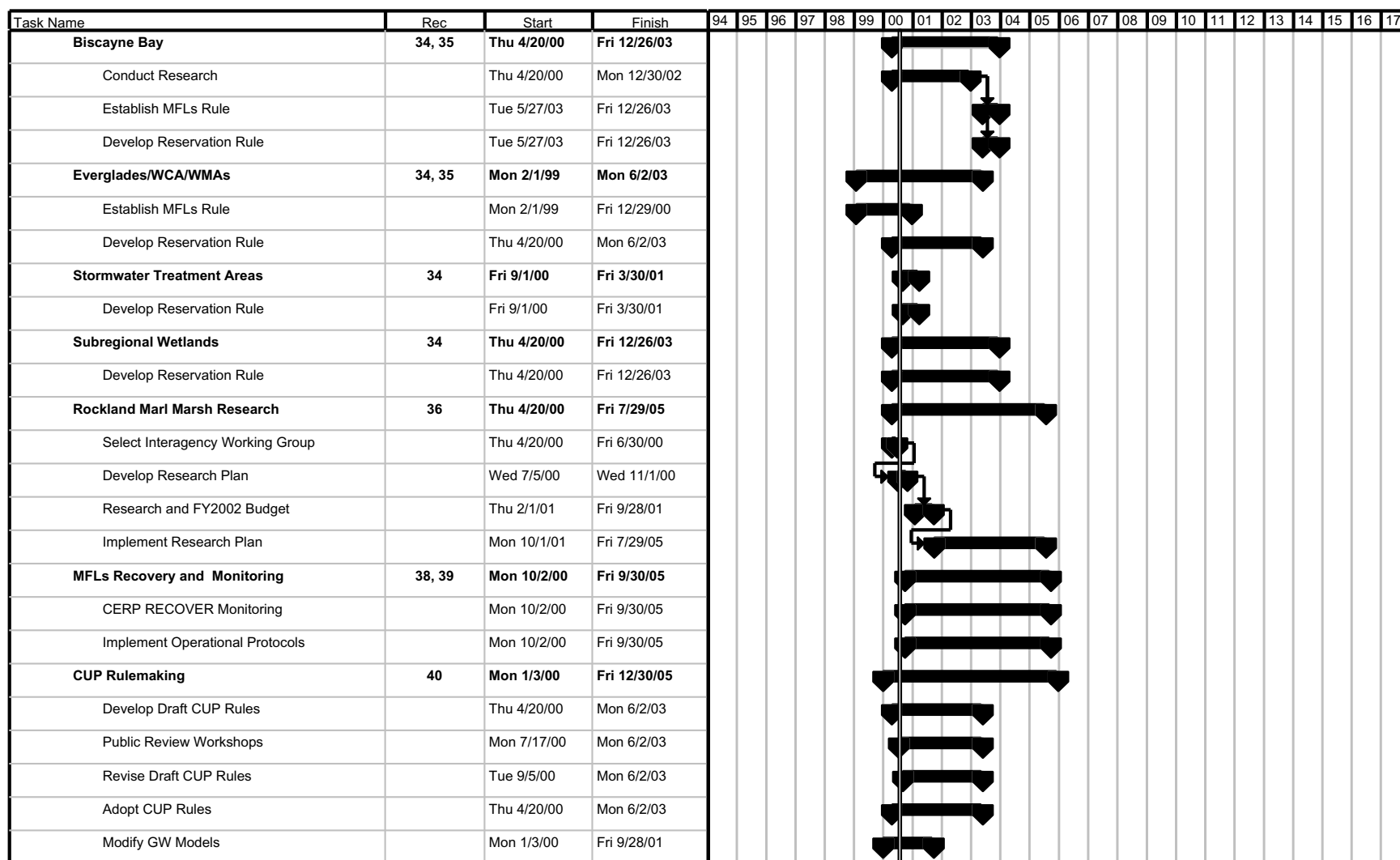


Figure 36. (Continued) Implementation Schedule for the Recommendations made within

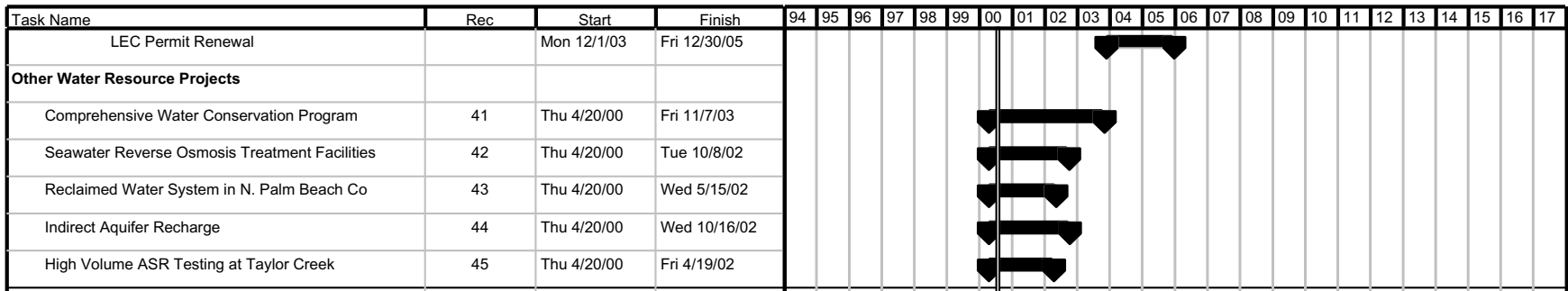


Figure 36. (Continued) Implementation Schedule for the Recommendations made within

